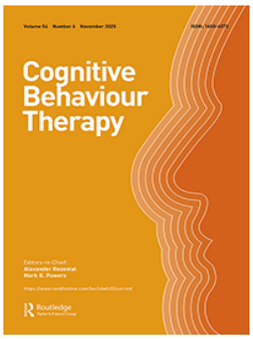

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Association between estimated intelligence quotient and treatment outcome in young patients with posttraumatic stress disorder treated with developmentally adapted cognitive processing therapy

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ABSTRACT

Higher pretreatment estimated intelligence quotient (IQ) has been associated with higher treatment gains in adult patients treated with cognitive processing therapy (CPT). We assessed the association between IQ and PTSD treatment outcome in young patients (14–21 years) with childhood abuse-related PTSD treated with developmentally adapted CPT (D-CPT). Participants ($N = 44$) of a randomized controlled trial assessing the effectiveness of D-CPT were tested with the Culture-Fair Intelligence Test before treatment. PTSD symptomatology was assessed with the Clinician-administered PTSD Scale for Children and Adolescents at baseline, midtreatment, posttreatment, and at 3-, 6-, and 12 months after end of therapy. Multilevel modeling was used to assess the association of IQ and PTSD symptom reduction at all assessment points. Binary regression was used to assess if IQ predicted PTSD remission and dropout. Results showed no association between IQ and PTSD symptom reduction ($\beta_{IQ \times time} = .12$, $t = 1.33$, $p = .19$). IQ did also not predict diagnostic status of PTSD at posttreatment ($\beta_{IQ} = .05$, $z = 1.22$, $p = .22$) nor dropout ($\beta_{IQ} = -.04$, $z = -1.04$, $p = .29$). Our results indicate that young patients with PTSD might profit from a D-CPT treatment independent of their IQ.

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Posttraumatic stress disorder; developmentally adapted cognitive processing disorder; estimated intelligence quotient; child and adolescent therapy; PTSD treatment gains

Introduction

The connection between a patient´s Intelligence Quotient (IQ) and the treatment effects has been established in early reviews on predictors of psychotherapy outcome (Smith & Glass, 1977). A positive association between (verbal) intelligence and treatment outcome has for example been found in patients with obsessive-compulsive disorder treated with cognitive-behavioral therapy (D'Alcante et al., 2012), or in patients with depression treated with cognitive therapy (Fournier et al., 2009).

Intelligence seems to predict the risk of experiencing trauma (Breslau et al., 2006), with, as well as the risk of developing PTSD, with individuals with lower IQ being more at risk for both aspects (Koenen et al., 2007; Kremen et al., 2007; Saltzman et al., 2006). Also, childhood trauma has been shown to negatively impact children's cognitive abilities (Delaney-Black et al., 2002; Kira et al., 2012; Samuelson et al., 2010). However, studies on the association between intelligence and treatment outcome in patients suffering from PTSD are very limited. In adults, higher levels of education, a proxy for intelligence, have been found to be associated with improvements in self-efficacy in veterans with PTSD (Cusack et al., 2019). Also, higher intelligence quotient has been found to be associated with a higher completion rate in a treatment trial of CPT for PTSD (Tillman et al., 2023). One study shows that adult patients with higher estimated intelligence quotients (IQ) benefit more from a treatment with Cognitive Processing Therapy (CPT) in terms of significantly greater PTSD symptom reductions than those with lower IQ (Marx et al., 2021). More specifically, individuals with higher IQ showed greater early symptom improvement than those with lower IQ. Nevertheless, also individuals with lower IQ could benefit from a treatment with CPT (Marx et al., 2021). On the other

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hand, Rizvi et al. (2009) found no association between intelligence and PTSD treatment outcome in female veterans treated with CPT.

Taken together, studies on the association between intelligence and treatment outcome in PTSD treatment have shown mixed results. To our knowledge, studies on this association in young patients with PTSD are thus far missing. If the effect of a psychological treatment for PTSD is related to pre-treatment intelligence, it is important to adjust the therapeutic techniques so that all patients can benefit equally.

The aim of the present study is therefore to assess the association between estimated intelligence and treatment outcome in young patients (aged 14–21 years) with PTSD treated with developmentally adapted CPT (D-CPT; Rosner et al., 2014). In CPT, cognitive techniques are employed to challenge dysfunctional cognitions and trauma-related beliefs (Resick et al., 2016). In a network meta-analysis, CPT was rated to be most effective for the treatment of PTSD in young people (Xiang et al., 2021). Cognitive techniques such as identifying and correcting dysfunctional thinking patterns and ultimately learning new ways of thinking may require high levels of cognitive functioning and a higher intelligence may facilitate that. Therefore, and following the finding in one adult patient population (Marx et al., 2021), we hypothesized that a higher estimated intelligence would be associated with greater treatment gains in terms of greater PTSD symptom reduction as well as in higher remission rates in our sample. Furthermore, following findings that show an association between pretreatment IQ and higher completion rate in adult patients (Tillman et al., 2023), we hypothesized that a higher IQ would predict a lower probability of dropping out of the study before treatment completion.

Method

We used data from a multicenter, 2-armed randomized controlled trial (RCT) that examined the efficacy of developmentally adapted cognitive processing therapy (D-CPT) in young adults (age 14–21 years) with childhood abuse-related PTSD compared to a waitlist/treatment as usual group (German Clinical Trials Register identifier: DRKS00004787). The study design is described in Rosner et al. (2014). D-CPT was effective in reducing PTSD symptoms as well as secondary outcomes (Rosner et al., 2019), treatment gains were stable up to 12 months follow-up assessments (Steil et al., 2022).

The study was approved by the institutional review boards of Catholic University Eichstaett-Ingolstadt, Eichstaett, Germany; the Freie Universitaet of Berlin, Berlin, Germany, and the Goethe University Frankfurt, Frankfurt am Main, Germany. Written informed consent was obtained from all participants and from parents or legal guardians of minors.

Participants

To be included in the study, participants had to have a primary diagnosis of PTSD related to child sexual and/or physical abuse. The threshold for PTSD diagnosis was lowered, because of the ongoing discussion on diagnostic criteria for PTSD in children (Cohen et al., 2010). Therefore, a minimum of two avoidance symptoms instead of three, as defined in the DSM-IV-TR (American Psychiatric Association, 2000), was required for a PTSD diagnosis. Further inclusion criteria were sufficient German language skills, no or stable pharmacological medication (for ≥3 weeks), and stable living conditions (no ongoing abuse, no homelessness). Exclusion criteria were current severe suicidality or severe and life-threatening suicidality or self-harming behavior within the last 6 months; an IQ of 75 or less, and/or any documented pervasive development disorder, concurrent psychotherapy, and the following diagnoses according to DSM-IV-TR: lifetime psychotic or bipolar disorder, current substance dependence (abstinence < 6 months), or a substance-induced disorder (Rosner et al., 2019).

Altogether, 88 individuals participated in the trial and were randomized to either the D-CPT condition ($N = 44$) or a Wait List plus Treatment Advice (WL/TA) group ($N = 44$). In the present study, we only used data from the D-CPT condition.

In the D-CPT condition, 12 participants did not complete therapy. Of those, seven participants dropped out of therapy and five were erroneously randomized (reasons were, for example Substance abuse revealed

later or having invented the traumatic experience). These five participants were not counted as dropouts for our analysis.

Therapists

D-CPT treatments were provided by 14 therapists. They had a mean (*SD*) clinical experience of 46.1 (19.3) months and had treated 3.3 (5.6) cases with PTSD before the trial. Therapists completed a 3-day workshop in D-CPT and treated one pilot case before entering the trial. The alliance between patients and therapists was high and therapeutic competence was good (Steil, Weiss, et al., 2023).

Assessments

Participants took part in diagnostic sessions before treatment (baseline), approximately 8 weeks after the start of treatment (midtreatment), after the end of treatment (posttreatment), as well as at 3-, 6-, and 12 months after the end of therapy.

Estimated intelligence quotient

At baseline, participants were tested with the Culture-Fair Intelligence Test (CFT-20-R, Weiß, 2006). The CFT-20-R contains language-free items in which participants complete a series of graphical figures. The test consists of two parts of similar structure, each with four subtests (series continuation, classifications, matrices, and topological reasoning). The first part contains 56 items and the second part 45 items that increase in difficulty. With the CFT-20-R, the general intellectual level is measured and described as the ability to recognize figural relationships and formal logical thought problems with varying degrees of complexity and to process them within a certain time (Weiß, 2006). As the CFT-20-R is a language free test, participants with poor knowledge of the German language were not disadvantaged. The internal consistency of the CFT-20-R is acceptable with Cronbach's Alpha = .72 (Weiß, 2006).

Posttraumatic stress disorder

PTSD severity was measured with the German version of the Clinician-administered PTSD Scale for Children and Adolescents (CAPS-CA, Nader et al., 1996; Steil & Füchsel, 2006). The CAPS-CA is a structured clinical interview in which frequency and intensity of PTSD symptoms are assessed on a scale from 0 (*never/no problem*) to 4 (*most of the time/extreme*) and the total scores can range from 0 to 136. The German version of the CAPS-CA has demonstrated good internal consistency (Cronbach's Alpha = .92) and good test–retest reliability (Intraclasscorrelationcoefficient = .88; Steil & Füchsel, 2006).

Treatment

D-CPT (Steil, Resick, et al., 2023) is an adaptation of CPT that was modified to meet the needs of adolescents and young adults after interpersonal abuse (for further information see Matulis et al., 2014). It consists of four treatment-phases: (1) The commitment phase, in which the therapeutic framework is established, treatment motivation and therapeutic alliance is enhanced; (2) a treatment phase in which emotion management techniques are integrated; (3) the intensive CPT-phase, in which sessions are applied in a high frequency (approximately 15 sessions in 4 weeks), and maladaptive thoughts are identified, stuck points challenged and the traumatic event is remembered by writing accounts; (4) the last phase in which special consideration is given to developmental tasks including, for example, education about potentially abusive partners, focus on educational aims and career choices or the development and enlisting of the social support network. Participants received thirty 50-min sessions (with six optional sessions) of D-CPT within 16 to 20 weeks.

Table 1. Results of hierarchical linear models.

Fixed Effects	Est.	*SE*	*t*	*p*
Model 1				
Intercept	72.11	3.85	18.76	<.001
Time	−10.21	1.07	−9.56	<.001
Model 2				
Intercept	109.17	28.10	3.89	<.001
Time	−22.76	9.47	32.57	<.05
IQ	−.37	.28	−1.33	=.19
Time x IQ	.12	.09	1.34	=.19

Note: Est. = Estimate; SE = Standard Error.

Statistical analysis

To test our hypothesis that higher estimated intelligence would be associated with greater treatment gains, we used multilevel modeling in R with data from all six assessment points (baseline, midtreatment, posttreatment, and 3, 6, and 12 months FU).

We defined two-level models (patients at level 2 and assessment time points at level 1) with random intercepts and random slopes and with CAPS-CA score as the dependent variable.

In a first step, time was included as fixed effect. In a second step, the interaction term IQ × time was included as a fixed effect to test the moderating effect of IQ over time points. Both models were compared with regard to their fit to the data using AIC.

We also assessed if IQ predicted remission from PTSD at posttreatment. For that, we calculated binomial regression models with diagnostic status as the binary dependent variable (1 = PTSD diagnosis, = no PTSD diagnosis) and pretreatment IQ as the independent variable.

To assess if IQ predicted treatment completion, we also calculated binomial regression models, with dropout as a binary dependent variable (1 = dropout before posttreatment, 0 = treatment completion).

Results

Altogether, $N = 44$ participants were randomized to the D-CPT condition, they had a mean age of 18.2 years ($SD = 2.36$ years) and were predominantly female (89%). Participants had a mean IQ of 98.95 ($SD = 14.92$), with a range between 80 and 124. Of the participants, 23 were still in school, while 8 had a high school diploma (German "Abitur"), 11 had a secondary school diploma (German "Realschulabschluss" or "Hauptschulabschluss"), and 2 dropped out of school. Most participants ($n = 26$) had experienced both physical and sexual abuse, $n = 11$ had experienced only physical abuse and $n = 7$ only sexual abuse. At Baseline, participants had a mean CAPS-CA score of 65.6 ($SD = 23.55$) and at 12-months FU of 19.7 ($SD = 21.84$). At posttreatment, $n = 6$ participants had not remitted from PTSD. Participants attended a mean (*SD*) of 25.4 (11.6) sessions, and $n = 26$ participants received at least one optional session.

Table 1 shows results of the hierarchical linear models. In the first model, time was a significant predictor of CAPS-CA scores through all measurement time points. Adding the interaction term time × IQ into the model (model 2) did not improve model fit (AIC model 1 = 1672 vs. AIC model 2 = 1674). Also, the interaction term did not emerge as a significant predictor of CAPS-CA scores ($\beta_{IQ\ x\ time} = .12$, $t = 1.33$, $p = .19$). This indicates that CAPS-CA scores significantly decreased from baseline over all further assessment points and that this reduction was independent of IQ.

Regarding the association between IQ and remission rate, the binary regression model did not show a significant association between IQ and PTSD diagnostic status at posttreatment ($\beta_{IQ} = .05$, $z = 1.22$, $p = .22$). The binary regression model for dropout showed that IQ did not predict treatment dropout ($\beta_{IQ} = -.04$, $z = -1.04$, $p = .29$).

Discussion

Contrary to our expectations, higher IQ was not associated with higher PTSD treatment gains in a sample of adolescents and young adults with abuse-related PTSD who were treated with D-CPT. The reduction of

PTSD symptom severity from baseline to 12 months follow-up was not influenced by IQ in our sample. Furthermore, IQ did not predict PTSD remission at posttreatment, nor did it predict treatment dropout.

In adults with PTSD, those with higher IQ have been shown to benefit more from CPT, more specifically, those with higher IQ showed greater early symptom improvement (Marx et al., 2021). The authors hypothesize that individuals with higher IQs might be better able to engage in key features of CPT such as challenging dysfunctional cognitions. Possibly, a reason why we did not find any association between IQ and treatment gains in young patients treated with D-CPT is that in D-CPT, we used simple language for designing the worksheets and psychoeducation sheets, as well as encouraging the therapists to use simple language within the sessions. Furthermore, D-CPT comprises more therapeutic elements than CPT. More emphasis is given to the building of treatment motivation, also easy-to-learn emotion and behavior regulation techniques are established, and a treatment module was added to specifically address developmental tasks like partner or career choice (Rosner et al., 2014). It is possible that these treatment modules have a beneficial effect on young patients with PTSD and that their influence is independent of IQ. In particular, the emphasis on building treatment motivation might explain that dropout was not related to IQ. There might be a difference between adults and youth with regard to the role of intelligence for treatment success. A further difference between our findings and those of Marx et al. (2021) is how estimated intelligence was assessed. Marx et al. (2021) used the Wechsler Test of Adult Reading (WTAR; Wechsler, 2001), in which participants read words of increasing pronunciation difficulty. In our study, we used CFT-R-20 (Weiß, 2006) in which participants have to complete graphical figures. It is possible that both tests capture different aspects of intelligence and that these are differently related to CPT treatment success. Furthermore, it is possible that the use of a more detailed assessment battery for measuring participants' IQ like the WTAR would have led to more reliable measures of IQ. It has been suggested that a detailed assessment of IQ should include a multilevel assessment and that the CFT-20-R is suitable for a first screening in this process (Kuhn et al., 2008). For our study, the CFT-20-R was the best option due to its time efficiency and the fact that it is language-free. Future studies should assess the relationship between treatment success in D-CPT and IQ assessed with a more detailed diagnostic process.

Our findings go in line with those of Rizvi et al. (2009), who also found no association between IQ and PTSD treatment gains in adult women treated with CPT. More research is necessary to find out if and under which circumstances intelligence might influence CPT or more general treatment success.

Our study has several limitations. Most importantly, our sample was rather small. When interpreting our results, it is important to mention the relatively low power of our study (post-hoc power calculations = 0.4) due to the small sample size. This increases the risk for Type-II errors (Kim, 2015); hence, it might be possible that the power of our study was not sufficient to detect an effect of IQ on treatment gains in D-CPT. The findings of our study should therefore be seen as preliminary. Second, the scattering of participants' IQ might have been somehow restricted, with four participants having an IQ lower than 85 and four with a higher IQ than 115. But this IQ range might be the usual one for clinical RCTs. Future studies should reassess the association between intelligence and D-CPT treatment outcome in a larger sample and with a larger scattering of IQ.

Lastly, it is important to mention that our study showed that D-CPT is an effective treatment for young patients with PTSD, probably independent of their IQ. We can only speculate about the reasons for the finding that treatment gains were not associated with IQ level in our study. In our view, the adaptation to easy language use was very important, but it is also possible that the low power of our study prevented us from finding an existing association.

Further research is necessary to identify predictors of treatment success in order to further ameliorate trauma treatments for this patient population.

Disclosure statement

Regina Steil and Rita Rosner receive honoraries for presentations and workshops on D-CPT.

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Data availability statement

The data that support the findings of this study are available from the corresponding author, Regina Steil, upon reasonable request.

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