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**Kategorie** (ankreuzen) **Forschungsarbeit X** **Projekt/Konzept**

### **Executive functions and motor abilities in pediatric cancer survivors – on the importance of motor coordination**

#### **Background:**

Due to the improved treatment and diagnostic tools, survival rates for pediatric cancer have increased up to over 80%. Nonetheless, Pediatric Cancer Survivors (PCS) bear a high risk for late effects, frequently associating cancer diagnoses with cognitive deficits. These late effects are caused by disease and treatment, and seem to be particularly harmful to specific cognitive processes such as executive functions. Executive functions are of high importance in childhood and adolescents because they are a predictor of academic achievement, with executive dysfunction having far reaching consequences on both the survivors' scholastic career and quality of life. In typically developing (TD) children the executive functions are related to motor abilities. Furthermore, the contributions of one's own motor abilities to the development of the physical self-concept are frequently reported, and the (physical) self-concept is central to psychological wellbeing.

Therefore, the aim of this study was to investigate executive functions and motor abilities in PCS, and also the relevance of motor coordination for physical self-concept and health related quality of life (HRQOL). Hypotheses were that there are significant differences in executive functions and motor abilities of PCS compared to TD children. In addition, we assumed a positive relationship between executive functions with motor abilities, and hypothesize that motor abilities are relevant for physical self-concept and consequently HRQOL.

#### **Methods**

In total, 81 PCS ( $n = 18$  with CNS;  $n = 63$  without CNS involvement) and 55 TD children and adolescents (comparable for age and gender) between 7-16 years of age ( $M = 11.14$ ;  $SD = 2.35$ ) participated in this study. Executive functions were assessed using the Stroop task (inhibition, shifting) and the Corsi Block task (updating). Motor abilities were assessed using the German Motor Ability Test (fitness, strength, coordination). Subsequently, for both scores a standardized composite score was calculated. In addition, the short form of the Physical Self-Description Questionnaire (PSDQ-S) and the Kidscreen-10 were used to assess physical self-concept and HRQOL. To compare executive functions and motor abilities, as well as physical self-concept and HRQOL between PCS and TD children, independent  $t$ -tests were calculated. To examine the relationships between motor abilities and executive functions, Pearson correlations were calculated. Additionally, the relationship between coordination performance, the physical self-concept facet and HRQOL was tested in a

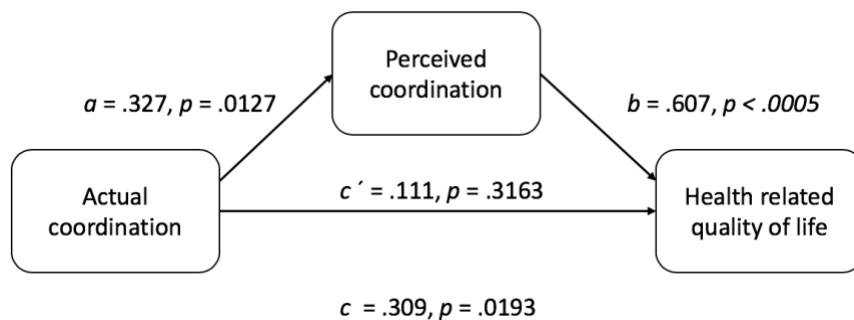
mediational model using PROCESS. Level of significance was set at  $p < .05$  for all analyses and results were Bonferroni corrected.

## Results

PCS showed a lower performance in executive functions ( $p < .0005$ ,  $g_{\text{Hedges}} = .640$ ) and in motor abilities ( $p < .0005$ ,  $g_{\text{Hedges}} = .888$ ). For all core executive functions, the obtained effects were of comparable sizes (inhibition:  $g_{\text{Hedges}} = .485$ ; shifting:  $g_{\text{Hedges}} = .392$ ; updating:  $g_{\text{Hedges}} = .449$ ). In motor abilities, the largest effect size between TD children and PCS was found for coordination (coordination:  $g_{\text{Hedges}} = .909$ ; strength:  $g_{\text{Hedges}} = .716$ ; fitness:  $g_{\text{Hedges}} = .621$ ). Executive functions were found to be highly correlated with coordination ( $r = .509$ ,  $p < .0005$ ), strength ( $r = .315$ ,  $p = .005$ ) and fitness ( $r = .351$ ,  $p = .003$ ), again, showing largest effects for the relationship with coordination.

PCS rated to have a lower physical self-concept only in the facet of coordination ( $p < .0005$ ,  $g_{\text{Hedges}} = .847$ ), but did not show a reduced HRQOL ( $p > .05$ ) compared with their peers. However, the physical self-concept facet of coordination was found to be strongly correlated with HRQOL in PCS ( $r = .410$ ,  $p < .0005$ ).

For Mediation analysis (see Figure 1), results showed that perceived coordination (the physical self-concept facet of coordination), significantly mediated the relationship between actual coordination performance and HRQOL. In detail, a 95% bias-corrected confidence interval based on 10,000 bootstrap samples indicated that the indirect effect ( $ab = .20$ ) was entirely above zero (0.0184 to 0.3949) and therefore significant.



**Figure 1** Mediation analysis on coordination and HRQOL in PCS. Actual coordination = Coordination in the German Motor Ability Test. Perceived coordination = Coordination facet of the PSDQ-S. HRQOL = Kidscreen-10.  $a$ ,  $b$ ,  $c'$  = standardized regression coefficients for the respective path.  $c$  = Total effect.

## Summary and discussion

Results show that lower executive functions and motor abilities are evident in PCS. In addition, executive functions and motor abilities are strongly related in PCS. Deficits caused by pediatric cancer, for example in motor abilities, negatively impact the physical self-concept with regard to coordination. Consequently, the contribution of actual coordination to HRQOL was mediated by the perceived coordination in PCS.

In conclusion, the assessment of motor abilities, and in particular motor coordination, should be included in standard aftercare in order to fully examine late effects in PCS. When considering the positive effects of physical exercise on executive functions, physical exercise interventions targeting motor coordination might have the power to contribute to the rehabilitation of executive functions and motor abilities in PCS. Results indicate that physical exercise interventions are warranted, and likely impact also HRQOL via improvements in physical self-concept.

## What this study adds:

- Lower executive functions and motor abilities were found in PCS and both are related.
- Actual/ perceived motor coordination contribute to HRQOL in PCS.
- Physical exercise interventions are likely to benefit the rehabilitation of PCS