

## Abstract Poster Submission Digital Health Lab Day 2022

### Title:

Digital pens for measuring fine motor skills in school-aged children with and without ADHD

### Authors/Affiliations:

D. Truninger<sup>1</sup>, A. Zysset<sup>1</sup>, S. Wehrli<sup>2</sup>, K. Albermann<sup>3</sup>, M. von Rhein<sup>\*4</sup>, F. Wieber<sup>\*1,5</sup>

<sup>1</sup>Zurich University of Applied Sciences ZHAW, Department of Health Science, Winterthur, Switzerland

<sup>2</sup>Zurich University of Applied Sciences ZHAW, Department of Social Work, Zurich, Switzerland

<sup>3</sup>Centre of Social Pediatrics, Cantonal Hospital Winterthur, Winterthur, Switzerland

<sup>4</sup>Child Development Center, University Children's Hospital Zurich, Zurich, Switzerland

<sup>5</sup>University of Konstanz, Konstanz, Germany

\* Equally contributed as senior authors

### Abstract

**Objective:** Attention-deficit/hyperactivity disorder (ADHD) represents a major public health issue with a broad range of negative outcomes for the affected individuals and with a serious social and financial burden to families and society. More than 50% of children with ADHD suffer from impaired handwriting (HW). Impaired HW and fine motor (FM) skills lead to emotional frustration and interfere with the ability to demonstrate knowledge or complete school work. Given this importance of FM and HW skills, reliable, valid and easily applicable methods to measure these skills are particularly relevant. Digital innovations offer opportunities to address this problem. A promising tool are digital pens that can measure graphomotor parameters such as stroke size pressure and writing speed. This pilot study aims to test the feasibility of automatically assessing HW and visuo-motor skills via digital pens and to investigate differences in graphomotor parameters between children with and without an ADHD diagnosis.

**Method:** In this cross-sectional-case-control-study, 31 children with ADHD ( $n_{ADHD}=15$ ) and without ADHD ( $n_{Control}=16$ ) aged between 8 and 12 years were recruited. All children completed a paper-pencil test measuring FM skills (Beery-VMI) and a HW test (SOS-2) where the children had to copy a given text using a digital pen. Using adjusted multiple linear regression analyses with bootstrapping method, the influence of group on individual test scores (Beery-VMI and SOS-2) and on digital pen data was evaluated. Age, intelligence, and gender were used as covariates for the model. Correlations between HW skills (SOS-2) and digital pen data were computed.

**Results:** The group variable does not seem to have a statistically significant effect on FM skills (Beery-VMI). No significant association between group and quantity of HW (SOS-2) were found. Significant group differences were found in the quality of HW as well as in the average letter sizes. HW speed and letter size from children with ADHD are significantly increased compared to the control-group. Strong correlations were found between some items of the SOS-2 and the digital pen data.

**Conclusion:** Digital pens are a feasible method to assess FM and HW skills. Measuring FM skills and HW digitally could be a complementary tool in the ADHD assessment. Digital data can also provide more information about FM problems and thus serve as a guide for (digital) training interventions.