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ABSTRACT

Introduction: In young children with early onset ataxia (EOA), quantitative rating of ataxia by the Scale for Assessment and Rating of Ataxia (SARA) is longitudinally influenced by the physiological age effect on motor coordination. To enable longitudinal quantitative interpretation of ataxia by SARA in children with EOA, the EPNS ataxia working group has previously determined SARA-scores in typically developing children (4–16 years of age). In toddlers, this information is still lacking. We therefore aimed to investigate the feasibility and reliability of SARA-scores in typically developing toddlers.

Methods: In 57 typically developing toddlers (2–4 years), we aimed to determine the: 1. feasibility of SARA-scores, 2. age-related pre-requisites to obtain SARA-scores in toddlers over all domains, 3. SARA-score reliability, 4. mathematical age connection of SARA-scores in toddlers and older children.

Results: In typically developing toddlers, the feasibility of SARA is strongly age-dependent ($p < .000$). After computing compensations for two age-related, unfeasible and therefore un-assessable kinetic subtasks and after allowing the videotaping of non-kinetic SARA sub-task performances at home, the SARA was fully reliably assessable in all ($n = 57$) toddlers (ICC = 0.732). From two to 16 years of age, SARA-scores were mathematically represented by one continuous, exponentially decreasing trend line approaching the adult-optimum at 16 years of age.

Conclusion: In toddlers, SARA-scores are reliably assessable, by using two age-compensations and allowing the videotaping of SARA-performances partly at home. In children with EOA, these data enable longitudinal quantification and interpretation of quantitative ataxia-scores by SARA from 2 years of age throughout childhood.

1. Introduction

The Scale for Assessment and Rating of Ataxia (SARA) is well-recognized as a reliable instrument for the quantification of ataxia in children and adults [1,2]. The SARA encompasses three subscales measuring different cerebellar domains including 1. gait and posture, 2. speech and, 3. kinetics, with a theoretical total sum-score from 0 (no ataxia) to 40 (most severe ataxia) [1]. Initially, the SARA scale was developed for measurement of ataxia in adult patients. In paediatric patients, however, we have indicated that the SARA-scale is also applicable, on the condition that scores are interpreted for the confounding influence by age (i.e., physiologically immature motor behaviour that mimics the official score criteria for "ataxia") [3]. Due to this overlap between physiologically immature motor behaviour and 'true ataxic' features, quantitative ataxia scores (SARA) in children with early onset ataxia (EOA) can be confounded by the age of the child [4,5]. In trials including young children with EOA, this may thus hamper the longitudinal investigation of a potentially therapeutic effect [6]. In a previous investigation, the ataxia working group of the European Paediatric Neurological Society (CACG-EPNS) has previously accounted for this by determining paediatric SARA-scores in a group of 156 typically developing children (aged 4–16 years) [5]. Results indicated an

Abbreviations: EOA, Early Onset Ataxia; SARA, Scale for the Assessment and Rating of Ataxia; EPNS, European Paediatric Neurology Society; ICC, Interclass Correlation Coefficient; HSS, Heel-shin slide; FAH, Fast alternating hand movements.

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exponential decline of SARA-scores and age [5]. Until now, such data are absent in toddlers (2–4 years of age). In typically developing toddlers, we reasoned that SARA tasks could be hampered by incomplete development of the central nervous system [7], resulting in insufficient comprehension [8] and limited attention span to accomplish all SARA tasks [9–12].

In typically developing toddlers (2–4 years of age), we thus set out to investigate the: 1. feasibility of SARA performances, 2. age-related prerequisites to obtain SARA-scores over all domains, 3. reliability of SARA-scores, and 4. mathematical age connection of SARA-scores in toddlers and older children. In typically developing children, we reasoned that such SARA-data would be important for: I. insight in the influence of physiological brain development on quantified motor coordination, and II. the achievement of control data enabling the longitudinal interpretation of therapeutic trials in children with EOA, from two years to 16 years of age.

2. Methods

The medical ethical committee of the University Medical Centre Groningen approved conductance of the study (METc 201900341). Typically developing toddlers were recruited by advertisements at day care centres, pre- and primary schools. Analogous to previous calculations on SARA age-relatedness in typically developing older children, we determined that the included number of children should be equal to n = 4, children per year of age, or higher [3,5]. Inclusion criteria were: "typically" developing children between 2 and 4 years of age, i.e., children who were attending day care centres or pre- and primary schools without the necessity of special needs or support and absence of exclusion criteria. Exclusion criteria were: 1. neurologic, cognitive or skeletal impairment, 2. medication that could theoretically interfere with motor behaviour and 3. Failed performance of the Gower's manoeuvre. We included a total number of 57 typically developing toddlers (2 years (n = 21), 3 years (n = 17) and 4 years (n = 19)).

This study consists of two parts: Part I (step 1–4) addresses the prerequisites to obtain SARA-scores in toddlers (2–4 years of age). Part II (step 5–6) addresses the outcomes, reliability and age-related association of SARA-scores in toddlers (2–4 years of age). For an overview of the methodological steps, see Fig. 1 (black text) and paragraphs 2.1–2.3.

2.1. Overview of methodological steps

2.1.1. Part I: Necessary adaptations to assess the SARA in toddlers

Step 1: To determine the feasibility of SARA-scores in toddlers, we

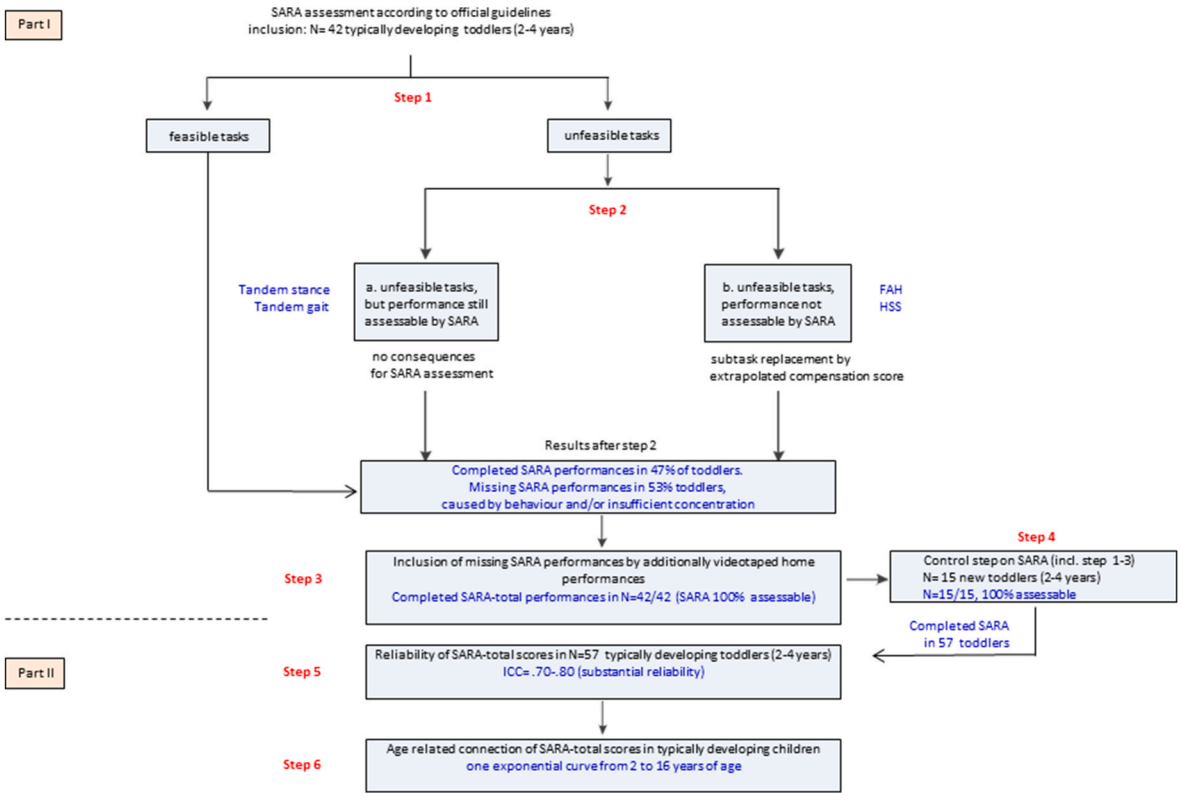

Fig. 1. SARA in typically developing toddlers.
The study is conducted in different steps. Step 1: In 42 toddlers (2–4 years of age) we determined the ability to perform all SARA tasks according to the official guidelines, i.e., at the test location, according to the guidelines (SARA-task feasibility). At 2,3 and 4 years of age, respectively 0%, 67% and 85% of the children were able to accomplish the full set of SARA performances. Step 2a: SARA subtasks that were physically un-feasible but still assessable according to the official SARA score-guidelines were tandem gait and tandem stance. Step 2a: At 2 and 3 years of age, SARA subtasks that were physically un-feasible and un-assessable according to the official SARA score-guidelines were FAH and HSS. At 2 and 3 years of age, FAH and HSS were replaced by a compensatory score, extrapolated from results in older children. Step 3: Missing SARA scores due to limited concentration span and/or toddlers' behaviour (43%) were compensated by allowing SARA performances on two occasions, if preferred at home. Step 1–3 resulted in fully assessable, complete data sets in all 42 included toddlers. Step 4: In 15 newly included toddlers (2–4 years of age), we confirmed reproducibility of our previous data regarding full feasibility of the SARA in toddlers (after Step 1–3), by application of the same methods used in the first set of 42 children. Step 5: Determination of SARA score reliability by inter-observer agreement (ICC). Step 6: Age related connection between SARA-total scores in typically developing toddlers (n = 57) and older children (4–16 years of age (n = 156)). Methodological steps are indicated with black, results in blue. From 2 to 16 years of age, SARA-scores describe one exponentially declining curve with age. Abbreviations: SARA = Scale for Assessment and Rating of Ataxia; FAH = fast alternating hand movements; HSS = heel shin slide. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

firstly included 42 typically developing toddlers (2 years (n = 17), 3 years (n = 12) and 4 years (n = 13)). For information of the included participants, see Supplementary Table I. From the video-recorded SARA performances, we determined the feasibility as the ability to perform the SARA tasks according to the official guidelines and instructions, so that the performances can be accurately scored (SARA-task feasibility) [1].

Step 2: We subdivided SARA sub-tasks that were not physically feasible into a. tasks that could still be officially rated for failure according to the SARA guidelines and, b. tasks that could *not* be rated for failure according to the SARA guidelines. We removed and replaced the unfeasible SARA subtasks that could not be rated (group b) by fixed, age-related compensations scores. Compensation scores were calculated as the predicted age-related value after extrapolation of SARA-scores in older typically developing children (4–16 years of age). Predicted values were derived from the previous European study [5], by fitting the related scores in a linear model with the predictors age and age-square on the natural logarithm of SARA-scores between 4 and 16 years of age [5]. Predicted values were transformed back and provided as the age-related compensatory value for the removal of both un-assessable SARA performances.

Step 3: To compensate for the toddlers' limited concentration span and/or shyness, we adapted the circumstances during the SARA video-recordings by allowing SARA performances on two occasions instead of one. Complex kinetic SARA subtasks (including tandem and kinetic performances) were always videotaped at the test location by the investigators. The videotaping of SARA gait, stance, sitting and speech performances were allowed at home (if preferred by the parents and/or child).

Step 4: After step 3, we checked whether SARA was fully feasible in all 42 included children. After fulfilling this condition, we added 15 newly included toddlers (2–4 years), to check reproducibility of full feasibility of the SARA (after inclusion of step 1–3), see Supplementary Table II.

2.1.2. Part II: Evaluation of the age-adapted SARA in toddlers

Step 5: After checking full feasibility of SARA (after step 1–3) in n = 57 (42 + 15) toddlers, we calculated inter-observer agreement (ICC) and the age-related numerical SARA values obtained in typically developing toddlers.

Step 6: Finally, we determined the relation between SARA-scores in typically developing toddlers (2–4 years of age) and older children (4–16 years of age [5]), by estimating the best fitting curve for all obtained SARA-scores per year of age, from 2 to 16 years of age.

2.2. Video-recordings

Video-recordings of all SARA performances were performed at day care centres, primary schools and children's homes. Parents, siblings, friends, babysitters and teachers were allowed to attend during the SARA performances, so that an encouraging, comfortable and safe environment for the children could be established. In all included children, video-recordings were firstly videotaped at the test location (including at least all kinetic tasks). The missing SARA performances were allowed to be videotaped by the parents at home. To avoid potential influences by different native languages and/or dialects and/or age-related language development, we used the syllable repetition task (involving 'la-la-la', 'ma-ma-ma' and 'putteke-putteke-putteke'), in addition to spoken language. Previously, we have shown a good correlation between the scores obtained by syllable repetition task and spoken language [5,13]. In case of any sign of resistance or exhaustion, we stopped recording and continued at another occasion.

2.3. Scoring

Videotaped SARA performances were rated by a team of four independent assessors for the child's ability to adhere to the official SARA instructions and the scoring [1]. These four assessors consisted of two experienced investigators (RB and DS (registrars in paediatric neurology and clinical investigators)) and two inexperienced investigators (KS and SP (medical students)). In accordance with the methods previously described by Lawerman et al. [5], SARA speech-sub scores were evaluated by spoken language and/or repetitive syllable tasks (la-la-la, ma-ma-ma etc.). In young children (4–16 years of age), we have previously shown that SARA speech-sub scores are well correlated when they are derived by spoken language and/or by repetitive syllable tasks [13]. All video-recordings were independently assessed off-line, without preceding information on the age of the child.

2.4. Statistical analysis

Statistical analysis was performed using SPSS statistics 23 for Windows. We derived feasibility by the percentages of children that fully performed the SARA. For descriptive statistics we calculated mean, median and ranges of SARA-scores, per year of age. Absent data that were not attributable to the toddler's physical, cognitive or behavioural development were reported as "missing value". We determined normality of mean scores, difference in feasibility and scores between boys and girls visually and by the Shapiro-Wilk test. We compared mean SARA-scores between the different age groups by the one-way ANOVA test (in case of non-normality we used the Kruskal-Wallis's test). Potential differences in feasibility as well as in scores between boys versus girls and also between home-versus test location performances were calculated by an independent *t*-test (in case of non-normality we used the Mann Whitney u test). Of all SARA sub-scores, we determined the interobserver reliability by calculating the Interclass Correlations Coefficients (ICC). We applied the two-way random, absolute agreement and single measurement setting for ICC calculations. We interpreted ICC scores by application of the criteria by Landis-Koch as: <0.20 = slight; 0.21 to 0.40 = fair; 0.41 to 0.60 = moderate; 0.61 to 0.80 = substantial and >0.81 = almost perfect [14]. We compared the ICC between experienced and inexperienced assessors by comparing inter-observer agreement. We considered a p-value <.*05* as significant.

3. Results

3.1. Part I: Feasibility of the SARA in toddlers

For an overview of outcomes after each methodological step, see figure 1 (blue text). Step 1: At 2, 3 and 4 years of age, respectively 0%, 67% and 85% of the children were able to complete the total SARA according to the official guidelines (i.e., scores obtained during one test performance at the test location (feasibility according to age; $p < .001$)).

Step 2: Unfeasible SARA tasks that could still be officially rated according to the SARA guidelines were: tandem -gait and tandem -stance. At 2, 3, and 4 years of age, the tandem -gait and tandem -stance performances were impossible due to physiologically insufficient balance in 100% (17/17), 100% (12/12) and 77% (10/13) of the toddlers at respectively 2, 3 and 4 years of age (boys versus girls *ns*; see Supplementary Table III). Unfeasible tandem performances can still be officially rated by the SARA as failure is included in the rating scale guidelines (by providing a minimal score of "2"; see also Attachments I-III). Unfeasible SARA performances that could not be officially rated in toddlers were exclusively present in toddlers of 2 and 3 years of age,

including: "fast alternating hand movements" (FAH) and "heel shin slide" (HSS). Unfeasible FAH performances were attributable to insufficient comprehension of the included time component that is associated with the task performance in 71% (12/17) and 17% (2/12) of the toddlers at respectively 2 and 3 years of age. These toddlers hesitated and performed the task with interruptions beyond the time-limit of 10 s. Unfeasible heel shin slide movements (HSS) were related with insufficient understanding of the required execution of the task (i.e., that the heel should maintain contact with the shin). Despite of repeated explanation, these toddlers slided with the ball of their foot along the shin. Inadequate performance accounted for 94% (16/17) and 33% (4/12) of the toddlers of 2 and 3 years of age, respectively. In children of 4 years of age, FAH and HSS task performances were adequately performed for assessment. In 2- and 3-year-olds, we thus replaced inadequately performed FAH and HSS SARA task performances by a compensatory score, since the official SARA scoring guidelines do not provide an option to rate such age-related "missing data". These compensation scores were determined by extrapolating the age-related SARA scores from older children (between 4 and 16 years of age [5] to the expected values in toddlers (2–3 years of age). At 2 years of age, calculated mean compensatory scores were 3.4 (FAH) and 1.7 (HSS) (rounded as: 3.5 and 1.5, respectively). At 3 years of age, the mean compensatory scores were 2.1 (FAH) and 1.3 (HSS) (rounded as: 2.0 and 1.5, respectively). Resultant SARA score forms in toddlers of 2, 3, and 4 years of age, are provided in Attachment I-III.

Step 3: Inclusion of missing SARA performances by additionally videotaped home performances. Although all other SARA sub task performances were physically feasible, limited concentration span and/or toddlers' behaviour (for instance by shyness or insufficient concentration) prohibited the assessment of full SARA data sets in 43% (15/17), 17% (2/12) and 8% (1/13) of the toddlers at 2, 3, and 4 years of age, respectively. In all children, the parents stated that their child would have been able to complete the SARA-task performances at home. After including the videotaped kinetic performances from the test location, we allowed the parents to videotape the missing SARA sub-task performances at home (when preferred). This resulted in fully assessable, complete data sets obtained from 42 included toddlers (see Fig. 1).

Step 4: To check full reproducibility of the SARA in toddlers (by incorporating step 1–3), we performed an additional pilot by including 15 new toddlers (2–4 years). After incorporating step 1–3, all 15 children were able to accomplish the SARA-total tasks, in a fully assessable way. In total, this resulted in 57 (42 + 15) videotaped and fully completed SARA data sets from all n = 57 included toddlers (2–4 years of age).

3.2. Part II: Outcomes, reliability and age-related association of SARA in toddlers

Step 5–6: Numerical SARA gait, stance, sitting and speech scores did not significantly differ between recordings from at-home or the test location. Mean SARA-scores with interquartile ranges are indicated in Table 1. For mean SARA total scores in toddlers per year of age, see Fig. 2. For SARA-total scores in association with age from 2 to 16 years of age, see Fig. 3. Inter-individual variety in SARA-scores increased from 2 to 4 years of age and declined from 4 to 16 years of age (both $p = .000$), see Fig. 3. At 2, 3 and 4- years of age, the inter-observer agreement (mean ICC) on SARA-scores was: *0.799, 0.737*, and *0.660* respectively. All ICC values are interpreted as "substantial" according to Landis-Koch. Connecting the SARA-total scores in toddlers (2–4 years of age) with the previously obtained SARA-total scores in typically developing children (4-to 16-years of age [5]), revealed one exponentially declining trend line between 2 and 16 years of age, see Fig. 3.

Table 1
Age-related SARA scores obtained in typically developing toddlers.

Age	2	3	4
SARA total scores	N = 4	N = 13	N = 17
Mean	13.0	8.0	6.5
Min	12.0	6.5	2.0
25%	12.5	7.0	5.0
50%	13.0	8.0	6.5
75%	13.5	8.5	8.0
Max	13.5	9.5	10.0
$SARA_{GAIT\ +\ POSTURE}$ *subscores*	N = 15	N = 16	N = 19
Mean	4.0	3.0	2.5
Min	3.0	2.0	1.0
25%	3.5	2.5	2.0
50%	4.0	3.0	3.0
75%	4.5	3.0	3.5
Max	5.0	4.0	5.0
$SARA_{SPEECH}$ *subscores*	N = 20	N = 17	N = 19
Mean	2.0	1.0	0.5
Min	1.5	0.0	0.0
25%	1.5	0.5	0.0
50%	2.0	1.0	0.5
75%	2.0	1.5	1.0
Max	3.0	3.0	1.5
$SARA_{KINETIC}$ *subscores*	N = 4	N = 13	N = 17
Mean	7.0	4.0	3.5
Min	6.5	2.5	1.0
25%	6.5	3.5	3.0
50%	7.0	4.0	4.0
75%	7.0	5.0	4.5
Max	7.0	5.5	6.0

Legend: Age-related SARA scores of healthy children. Min, minimum; 25%, lower quartile; 50%, median; 75%, upper quartile; Max, maximum. Scores are rounded to 0.5 points.

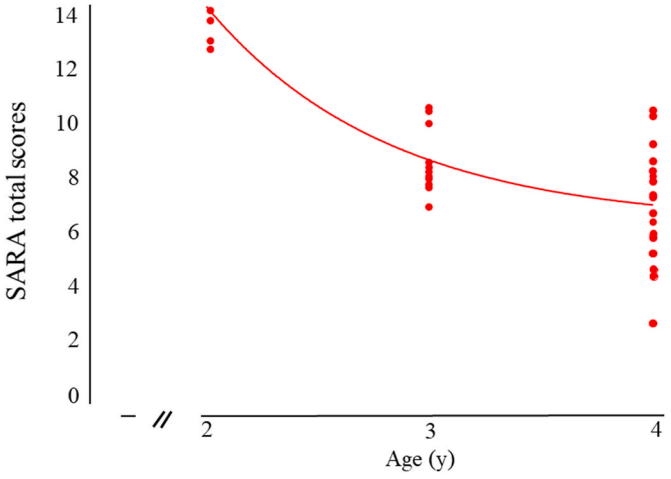

Fig. 2. SARA total scores of toddlers in accordance with age.
A polynomial analysis with one phase decay trend line represents the connection between summed SARA-total scores according to age. The vertical axis indicates the summed SARA-total score. The horizontal axis indicates age in years. For each individual child (including the first set of children (n = 42) and the second set of children (n = 15)), mean data points are given. This figure reveals that SARA total scores decline with age. Abbreviations: SARA = Scale for Assessment and Rating of Ataxia.

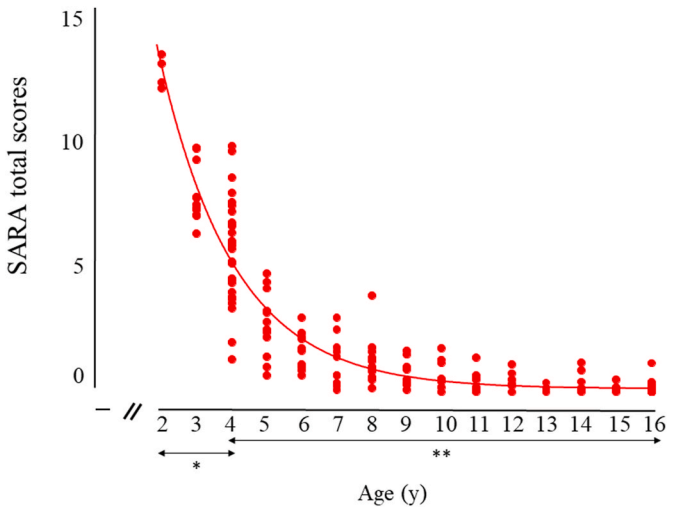

Fig. 3. SARA-total scores of typically developing children aged 2–16 years.
This figure shows the association between summed age-related SARA-total scores in typically developing toddlers and older children [5]. The figure shows the presently obtained data points in toddlers from 2 up to 4 years of age, in connection with the data points derived from the previous study in older children (4–16 years of age) by Lawerman et al. [5] Due to the chosen study connection at 4 years of age, the number of datapoints was larger at 4 years of age than at the other ages, i.e. n = 21 (at 2 years), n = 17 (at 3 years), n = 31 (at 4 years), and n = 12 (from 4 up to 16 years of age). The vertical axis indicates the summed SARA-total scores. The horizontal axis indicates age in years. Between 2 and 16 years of age, SARA-total scores are connected by a polynomial analysis with one phase decay trend line. *= data points derived from the present study in toddlers; ** data points derived from the previous study in older children (4–16 years of age) by Lawerman et al. [5] Abbreviations: SARA = Scale for Assessment and Rating of Ataxia.

4. Discussion

To enable longitudinal quantification of ataxia in children with EOA from 2 years of age onwards, we investigated the feasibility of SARA performances in typically developing toddlers. To the best of our knowledge, this is the first study investigating the feasibility of an ataxia rating scale in typically developing toddlers of 2–4 years of age. Our data show that the SARA is reliably assessable in toddlers after two prerequisites: 1. age compensations for two unachievable data-points (since the performances could not be adequately scored (FAH and HSS)), and 2. partial inclusion of SARA home video-recordings, if preferred by the parents and/or child. In typically developing children from 2 to 16 years of age, we observed an exponential decline between SARA-scores and age, reflecting the effect by physiological brain development on motor coordination instead of "ataxia". In typically developing children, these SARA data thus provide us with: I. insight in the influence of physiological brain development on quantified motor coordination, and II. control data enabling the longitudinal interpretation of therapeutic trials in children with EOA by SARA, from two years to up to 16 years of age.

In young children with EOA, the invention of new treatment strategies may urge the need for objective tools to measure the effect. For this purpose, the SARA is described as a reliable and clinically well-applicable rating scale. Initially, the SARA was developed as a measurement tool for ataxia quantification in adults [1]. However, we have previously shown that the SARA is also well-applicable in children, as long as the scores are interpreted for the confounding effect by age (e.g. brain maturation) [3]. In young children, the cerebellar, parietal- and prefrontal-cortical areas are still being shaped by maturation, including activity-dependent synaptic pruning and myelination of neural connections [15–21]. Especially cerebellar development concurs with childhood, being completed at about puberty [8,22]. This is reflected by paediatric motor coordination approaching the adult standards by 16 years of age [3,5,23–27]. As the SARA is originally designed to measure cerebellar function in the adult, and as cerebellar motor output is related with cerebellar development, it is thus no surprise that immaturity may confound SARA-scores by representing "physiological brain development" instead of "ataxia" [5]. Previously, the ataxia working group of the EPNS has therefore reported paediatric SARA-scores in 156 typically developing children, revealing an exponential decline between paediatric SARA-scores and age, between 4 and 16 years of age [5], after adult values were approached. In the present study, we determined the SARA feasibility and scores in toddlers between 2 and 4 years of age.

In typically developing toddlers, our data show that SARA-scores reveal a similar physiological age-association as in older children. This is well-illustrated by the imbalanced "tandem" -gait and -stance performances, resulting in falsely positive SARA "ataxia scores", due to incomplete cerebellar maturation [28]. Additionally, toddlers were often insufficiently able to adhere to the SARA criteria for FAH and HSS kinetic sub-tasks, resulting in missing scores. This was compensated by determining numerical extrapolations from the FAH and HSS scores that were previously determined in older children [5]. Furthermore, SARA data sets were hampered by the toddler's limited concentration span, which were compensated by the inclusion of SARA performances that were videotaped by the parents at-home. After these adaptations, our data show that the SARA-total can be accomplished by toddlers, in a reproducible and also reliably assessable way. In line with the late development of the cerebellum, the developing cortex of the cerebrum [29,30] is also likely to influence the accomplishment of the SARA. Especially developing (pre)frontal cortical area's interconnecting with the posterior (cognitive and limbic) parts of the cerebellum [31], are also likely to have an effect on the feasibility by task-limiting "toddler's behaviour". For instance, prefrontal lobe development underlies executive abilities [9,27] including inhibition of inappropriate thoughts, adverse behaviour, distractions, and anxiety [8,9]. In our study, this limitation was overcome by the permission to execute non-kinetic SARA tasks partly at home, resulting in full SARA-data sets in all toddlers. Under the premise that SARA recordings do not differ between at-home and test locations, Summa et al., have also used the at-home location to quantify SARA performances in older children by using the Kinect [31]. As SARA sub-scores did not differ between at-home and test locations, neither in our and in the previous study, we included the missing home-videotaped performances to complete the data-sets.

Analogous to SARA-scores in older children [5], the reliability of SARA-scores (ICC) in toddlers were interpreted as "substantial". Furthermore, SARA-scores in toddlers revealed a similarly declining exponential trend with age as observed in older children [5]. As could be expected, we observed the largest variation in scores at the "transition age" of four years, as this age was included in the present toddler study (2–4 years of age) and also in the previous paediatric study in older children (4–16 years of age [5]), resulting in a larger number of data-points by the combined studies. However, in children of 4 years of age, the variation in scores still seemed relatively large when compared with the younger toddlers. This could potentially reflect the fact that children of 4 years of age performed the SARA, without being age-compensated for the difficult kinetic FAH and HSS subtasks, whereas the children of 2 and 3 years of age received a fixed compensation score for both the FAH and HSS tasks. Associating the age-related SARA values in typically developing toddlers (2–4 years) with those in older children (4–16 years of age [5]), revealed one continuous, exponentially decreasing trend line from 2 years of age onwards, that had approached the "adult optimum" at 16 years of age [5]. As young children with EOA can still reveal the same age-related physiological SARA-score decline at an early disease stage [32], it is important to consider this age-effect before attributing declining scores to a therapeutic effect [33,34]. Altogether, our data show that the SARA is assessable from 2 years of age onwards. In typically developing children,

these SARA data can provide insight in the influence of physiological brain development on the quantification of motor coordination and can also provide control data for the longitudinal interpretation of SARA-scores for "ataxia"-measurement in young children with EOA.

We recognize some limitations to this study. Although statistically adequate, we are aware that the sample size of the present study can be further augmented. Together with the ataxia interest group from the EPNS, we hope to obtain such control values in an international setting, analogous with the previously reported study in older children [5]. However, in perspective of our previous experience [3,5], we would anticipate that results remain comparable.

In conclusion, the present study shows that the SARA is assessable in toddlers from 2 years of age onwards. These developmental data in typically developing children may contribute to the interpretation of longitudinal therapeutic trials in children with EOA.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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