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Does childhood reading disability or its continuance into adulthood underlie problems in adult-age psychosocial well-being? A follow-up study

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Abstract

This follow-up study aimed at a better understanding of the associations of reading disability (RD) with adult-age psychosocial wellbeing. We compared adult-age psychosocial wellbeing in 48 individuals (20-39 years) with documented childhood RD but without comorbid disabilities to 37 matched controls. The associations of psychosocial wellbeing with childhood and adult-age reading fluency were studied in the RD group, controlling for IQ, gender and unemployment. Psychosocial wellbeing was assessed with commonly used self-report questionnaires. No group differences were found in psychosocial wellbeing. In the RD group, lower adult-age reading fluency was associated with symptoms of depression, lower self-esteem and social functioning. Severity of childhood RD was not associated with psychosocial wellbeing. Thus, reading fluency problems continuing into adulthood appear to be related to adult-age psychosocial wellbeing. A more holistic approach to studying how RD impacts adult-age wellbeing is needed, including both the individual's developmental history and current functioning in various domains.

Keywords: adults, longitudinal, psychosocial wellbeing, reading disability.

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Reading disability (RD) shows high persistence from childhood across adolescence (e.g., Eklund, Torppa, Aro, Leppänen, & Lyytinen, 2015) and has also been reported to be highly persistent into adulthood (Maughan et al., 2009). RD is also associated with psychosocial wellbeing problems in childhood and adolescence (for a review see Livingston, Siegel, & Ribary, 2018). However, research on the impact of RD on individuals' psychosocial wellbeing beyond adolescence is scarce. This study aimed at furthering understanding of the association between RD and adult-age psychosocial wellbeing (i.e., symptoms of depression, self-satisfaction, self-esteem, persistence, and social functioning) in adults with a known childhood history of RD.

High proportions of problems in psychosocial wellbeing have been found among adult-age individuals with RD (e.g., Carawan, Nalavany, & Jenkins, 2016; Ghisi, Bottesi, Re, Cerea, & Mammarella 2016; for a review see Livingston et al., 2018). However, adults with RD and with good self-evaluated persistence to overcome difficulties have been found to report lower levels of psychiatric symptoms (Campbell-Sills, Cohan, & Stein, 2006), and higher life satisfaction (Stack-Cutler, Parrila, & Torppa, 2015). Yet, follow-up studies from childhood into adulthood of individuals with documented childhood RD are rare. Among the few such studies, findings on the impact of RD on the adult-age psychosocial wellbeing of these individuals vary from less favorable (e.g., Undheim, 2003) to more positive (e.g., Schulte-Körne, Deimel, Jungermann, & Remschmidt, 2003).

In their follow-up studies of population-based samples, Esser, Wyschkon, & Schmidt (2002), Maughan & Hagell (1996) and Undheim (2003) found more psychiatric, social and emotional problems amongst individuals with RD compared to controls. Esser and colleagues (2002) followed up 31 individuals at age 25 who had been diagnosed with RD at age eight in a population-based screening program, and compared them to a control group and to a group with other developmental disorders. Undheim (2003) followed up individuals

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diagnosed with RD at age ten, derived from a cohort sample, and compared them to a control group and to a group of former child psychiatric clinic clients with RD. At age 23, the most severe problems were found in the cohort-based RD group. In the study of Maughan and Hagell (1996) on a population-based sample of 127 poor readers and 73 normal readers followed from age ten into adulthood (27-28 years), the participants with RD, especially women, had more problems in social relationships and more psychiatric disorders than controls.

In contrast to the studies mentioned above, in their follow-up studies of clinical samples, neither Strehlow, Kluge, Möller, and Haffner (1992) nor Schulte-Körne and colleagues (2003) found higher proportions of psychiatric or emotional symptoms in individuals with RD. Strehlow and colleagues (1992) followed up a sample of 59 former clients of a child psychiatric clinic twelve years after RD diagnosis at age ten. Schulte-Körne and colleagues (2003) in turn followed up 29 students at a boarding school for dyslexic children 20 years after RD diagnosis at age eleven.

In sum, despite their conflicting results, the few earlier longitudinal studies of RD suggest that RD could influence adult-age psychosocial wellbeing. However, these studies did not control either for the severity of childhood RD or adult-age reading skills, or they used the severity of childhood RD as a predictor of adult-age reading but not of wellbeing (Schulte-Körne et al., 2003). It therefore remains unclear whether childhood RD *per se* or its continuity into adult-age is associated with psychosocial wellbeing. Another confounding factor is comorbidity: RD is known to co-occur with other learning (e.g., Landerl & Moll, 2010) or developmental difficulties, such as ADHD (e.g., Margari et al., 2013; Willcutt et al., 2010). Nevertheless, few studies have analyzed the influence of comorbidity on psychosocial wellbeing. Exceptions include Esser and colleagues (2002) and Undheim (2003), who compared their RD groups with groups exhibiting other disorders: Esser and colleagues

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(2002) with a group with other developmental disabilities, and Undheim (2003) with a comorbid RD and psychiatric problems group. Undheim (2003) concluded that problems in some aspects of psychosocial wellbeing may partially be explained by comorbid childhood psychiatric problems. Both studies, however, also reported elevated risk for psychosocial wellbeing problems in RD samples without comorbid disabilities. The results are thus unclear. Moreover, neither of the two studies report controlling for comorbid LDs in the groups with RD. Distinguishing the effect of comorbidity from that of RD *per se* on adult-age psychosocial wellbeing problems is thus problematic.

To better understand the influence of RD *per se* on adult-age psychosocial wellbeing, we report our findings for an adult-age sample of individuals who had been diagnosed with RD in childhood but without any comorbid learning or psychological disorders. Our clinical sample was thus highly homogeneous, with as few confounding factors as possible, enabling us to focus on RD and its possible later psychosocial correlates. The sample was compared to a population-based control group. We analyzed the effect of both severity of childhood RD and adult-age reading fluency on psychosocial wellbeing, and examined several aspects of the multifaceted concept of psychosocial wellbeing, from the individual's inner experiences of self (symptoms of depression, self-satisfaction, self-esteem) to the more social and functional aspects of wellbeing (social functioning, persistence to overcome difficulties).

Furthermore, we aimed to gain greater insight into differences in wellbeing in the RD group by controlling for the effect of IQ, gender, and unemployment. Individuals with higher IQ have been found to show better adult-age reading skills (Ferrer, Shaywitz, Holahan, Marchione, & Shaywitz, 2010), and individuals with RD combined with lower IQ to be at higher risk for unemployment (Caspi, Entner, Wright, Moffitt, & Silva, 1998). We assumed that IQ would also be related to psychosocial wellbeing in the present RD group. In addition,

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women are known to be more prone to symptoms of depression than men (e.g., Kessler, 2003), and psychosocial problems have been found to be more common among women with RD than male counterparts (Maughan & Hagell, 1996), which is why we also expected more psychosocial wellbeing problems to be found among women than among men in the present RD sample. Moreover, some earlier studies have found higher unemployment rates among individuals with RD compared to their controls (e.g., Undheim, 2003). Therefore, we controlled unemployment in the analyses regarding the childhood RD group.

To address the aforementioned gaps in the earlier research, we sought answers to the following questions:

1. Are there differences in psychosocial wellbeing (experience of symptoms of depression, self-satisfaction, self-esteem, persistence to overcome difficulties, and social functioning) between adults with childhood RD and adults with no documented childhood RD, and, if so, are these differences associated with gender or IQ?

2. Is there an association (after controlling for IQ, gender and unemployment) in adults with childhood RD between adult-age psychosocial wellbeing and the severity of childhood RD or adult-age reading skill?

Method

Participants

Two groups of participants were recruited: Finnish adults who had been diagnosed with RD in childhood (RD group; $n = 48$) and controls ($n = 37$). Participants for the RD group were selected from the client archives of the [name deleted to maintain the integrity of the review process], which offers neuropsychological assessment for children with LDs or attention problems (for details see Närhi, 2002). Children were typically referred by school psychologists and had received special education services at school prior to clinical assessment. We selected participants for the RD group from a larger longitudinal register-

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based data of former clients of the clinic, with a follow-up age of at least 20 years ($n = 509$), of which 317 (62.3%) had RD, with some of them also having comorbid other problems along with RD. Seventy-six, i.e., approximately a fourth (23.9%), of all the individuals with RD had RD as their only childhood LD ($z\text{-score} \leq -1.5$), with no comorbid mathematical disability ($z\text{-score} > -1.5$) or psychological problems ($z\text{-score} > -1.0$ in teacher/parent ratings). Of the sample of these 76 individuals, 66 were reached. For nine individuals, no contact information was available, and one person had died. Forty-nine individuals (74.2% of those reached) agreed to participate in the follow-up; one was omitted from the sample owing to low childhood IQ (full scale IQ 60). Thus, the final RD group size was 48. The RD participants had attended the clinic at age eight to 13 years ($M=10.7$ years). All the participants were native speakers of Finnish.

The control group was assembled from the Population Register Center. Each RD group member was matched with five control individuals for age, gender and home town at the age of seven, i.e., at the beginning of compulsory education. We then contacted all five with the aim of recruiting one matched control for each study group member. No controls were available for eleven of the RD participants either because they were not reached or because they declined to participate or cancelled their participation. Thus, the final control group size was 37.

In the RD group, based on the available data, no differences were found between participants ($n=48$) and non-participants ($n=27$) in age, childhood RD level, VIQ or PIQ, psychological problems, or in parental level of education. There were slightly more males among the non-participants (81.5%) than participants (62.5%), but the difference was not significant.

Procedure

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The primary method of contacting subjects was a telephone call, which included sharing basic information about the project, arranging one-on-one appointments (if the subject consented to participate), and a preliminary interview on, e.g., education, employment, and special education. The follow-up assessments for the RD group and the control participants were conducted by licensed psychologists on the premises of the [name deleted to maintain the integrity of the review process]. Each appointment lasted four and a half to five hours and was primarily arranged during the day time on workdays. The assessments included standardized tests evaluating cognitive and academic skills as well as interviews and self-rating questionnaires. In the self-rating questionnaires, the instructions were given orally and the participants were encouraged not to hesitate to ask if anything was unclear while completing the questionnaire, so as to ensure that the text would be understandable. The assessments were not blind to group status as some of the interview questions directly dealt with RD and were therefore omitted or reformulated for the control participants.

Each participant was paid daily allowance in compensation and received travelling expenses and lunch or a snack during the assessment break. The participants were given oral feedback on their test performance at the end of the appointment, and offered a short written summary of the main test results by mail.

Ethical Considerations

Ethical approval for the follow-up was given by the Ethical Committee of the University of Jyväskylä, and the study followed the ethical standards of the Declaration of Helsinki. All the participants participated voluntarily and gave their written informed consent. Parents of the RD group individuals had given their informed consent to use their children's test data for research purposes when the participants had been assessed as children.

Measures

Severity of childhood RD

Reading fluency, i.e., speed, was used to measure both childhood RD and adult-age reading skills: in a shallow orthography like Finnish, with consistent letter-sound relationships, reading accuracy is typically learned quickly (Aro & Wimmer, 2003), and hence reading speed is a better marker of reading difficulties than reading accuracy in Finnish, especially in adulthood. Moreover, oral reading fluency has been considered to reflect overall reading competence (see Fuchs, Fuchs, Hosp, & Jenkins, 2001) and is therefore an adequate measure of reading skills.

Childhood RD was assessed by oral reading speed in one of two text-reading tests commonly used at the clinic. Misku (Niilo Mäki Institute, 1992, unpublished) is an age-normed text-reading task for eight- to twelve-year-old children, while the ÄRPS text reading task (Niilo Mäki Institute, 1994, unpublished) is a test normed for second to fourth graders. In both tests, the child reads aloud a one-page story as quickly and accurately as possible. The time taken to complete the text was measured in the Misku and the number of words read per time unit was measured in the ÄRPS.

As the participants had attended the clinic in different times, different tests had been used to measure their reading skills in childhood. The two reading tests used were not fully commensurable, one measuring time taken to complete a text and the other the number of words read per time unit, and therefore, the variances of the z-scores in the tests differed substantially. Hence, we preferred not to use a continuous measure for childhood reading skill level, but instead formed a dichotomous variable on the basis of the z-score calculated based on either of the two tests. The z-scores were computed based on Finnish normative data separately for each test. A z-score of at least -1.5 SDs below the reference group mean was used as the cut-off criteria for RD. Childhood RD was further dichotomized as two RD subgroups as follows: “severe” (below -2.5 SDs) or “RD” (-2.5 to -1.5 SDs).”

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Adult-age reading fluency

A Finnish test battery for reading and spelling for use with adolescents and adults (Nevala, Kairaluoma, Ahonen, Aro, & Holopainen, 2006), with a standardization sample of comprehensive school ninth graders (n=208), was used to assess reading skills in adulthood. In the subtests *Word Reading Task* and *Pseudo-Word Reading Task*, the participants read aloud 30 Finnish words or 30 pseudo-words as fast and accurately as possible; the time taken was recorded and the number of correctly read words counted. In the subtest *Text Reading Task*, participants read aloud a text for three minutes as fast and accurately as possible and the number of correctly read words and errors was counted.

Reading fluency was determined as the mean of the reference data based z-scores of the time used in (1) the *Word* and (2) the *Pseudo-Word Reading Task*, and the number of words read in three minutes in (3) the *Text Reading Task*. Cronbach's alpha was .78.

Psychosocial wellbeing measures

Symptoms of depression. Depression was measured with the Beck Depression Inventory -II (BDI-II; Beck, Steer, & Brown, 1996), a 21-item self-rating questionnaire. Participants respond to statements on a four-point Likert scale ranging from zero to three in the intensity of the symptom in question, such as sadness or self-dislike (e.g., 0 = I don't feel I am any worse than anybody else; 3 = I blame myself for everything bad that happens). Higher scores indicate more symptoms of depression. The sum score of all items was used in the present study, the highest possible value being 63. Cronbach's alpha was .66.

Self-satisfaction and social functioning. The sum scores of the domains Wellbeing and Functioning of the Clinical Outcomes of Routine Evaluation – Outcome Measure (CORE-OM; Evans et al., 2002) were used to measure self-satisfaction and social functioning, respectively. The CORE-OM is a 34-item self-report questionnaire including

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domains of Wellbeing (four items measuring self-satisfaction and hopefulness), Functioning (twelve items measuring functioning mainly in social encounters), Symptoms (twelve items measuring e.g., anxiety, pain, and unpleasant emotions), and Risk (six items measuring risk of harming self or others). Participants respond to statements on a five-point Likert scale ranging from zero (“not at all”) to four (“most of the time”) in the intensity of the emotion or function being described. In the domain Wellbeing, the statements describe emotions or states such as “I have felt like crying” or “I have felt optimistic about my future”. In the domain Functioning, the individual responds to statements like “I have felt I have someone to turn to for support when needed”, or “Talking to people has felt too much for me”. The statements indicating positive states in the both domains are on reversed scales, so that higher scores indicate more problems in wellbeing or in social functioning. The sum scores of all items for both domains were used as measures in the present study, the highest possible sum score in the Wellbeing being 16 and that in the Functioning 48. The domain Wellbeing had a Cronbach’s alpha reliability of .48 and the domain Functioning a Cronbach’s alpha of .65 in the present sample. Cronbach’s alphas of .64 for Wellbeing and .79 for Functioning have been reported for the general population in a Finnish validation study (Juntunen, Piiparinen, Honkalampi, Inkinen, & Laitila, 2015).

Self-esteem. Self-esteem was measured with the abbreviated version of the Rosenberg Self-Esteem Scale (RGSE; Rosenberg, 1965), a self-report measure comprising five statements relating to self-esteem (e.g., “I feel that I have a number of good qualities.”) to which individuals respond on a five-point Likert-scale (from “strongly disagree”, to “strongly agree”). Higher scores indicate less self-esteem problems. The highest possible sum score of the five items is 20. Here, the sum score of all statements was used, and Cronbach’s alpha was .79.

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Persistence to overcome difficulties. Self-evaluated persistence was estimated with the Connor-Davidson Resilience Scale -10 (CD-RISC-10; Campbell-Sills & Stein, 2007) which comprises ten statements measuring the capacity to cope with adversity, such as “I am not easily discouraged by failure” or “Coping with stress can strengthen me” to which individuals respond on a five-point Likert scale ranging from “not true at all” to “true nearly all the time”. Higher scores indicate stronger persistence. The sum score of all items was used as a measure of persistence, the highest possible sum score being 40. The Cronbach’s alpha in the present study was .89 as compared to the value of .85 reported in an earlier study (Campbell-Sills & Stein, 2007).

Unemployment. *Current employment status* was gained from the participants’ pre-assessment telephone interviews. A dichotomous variable was formed with categories 0=“employed” and 1=“unemployed”. The participants were classified as unemployed if they were job-seekers or laid off, and not studying, working full-time or part-time, doing military service, on maternity or sickness leave, or on a disability pension.

IQ. Full Scale IQ (FSIQ) was estimated using the abbreviated version of the Wechsler Adult Intelligence Scale – IV (WAIS IV, Wechsler, 2008; Finnish standardization). As in the Wechsler Abbreviated Scale of Intelligence – II (WASI-II, Wechsler, 2011; see e.g., Irby & Floyd, 2013), the subtests Vocabulary and Similarities were used to produce a Verbal Comprehension Index (VCI) and the subtests Block Design and Matrix Reasoning to produce a Perceptual Reasoning Index (PRI), and were computed using partition according to the WAIS IV test manual (Wechsler, 2008; Finnish standardization). Working Memory Index (WMI) and Processing Speed Index (PSI) were used as whole measures in computing the FSIQ. Test-retest reliability above .90 for FSIQ in abbreviated WAIS-IV versions is commonly reported (Irby & Floyd, 2013).

Statistical analyses

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Correlations and univariate general linear model (GLM) analyses were used to answer the research questions. Because the distributions of the psychosocial wellbeing measures were not normal, the results of the GLM analyses were tested using bootstrapped (Boos & Stefanski, 2010) confidence intervals (95%) with 1 000 replications. To evaluate the statistical power of the group comparisons, we used partial eta squared (η^2) as an effect size. A partial eta squared of 0.01 to 0.06 is considered as small, that of 0.06 to 0.14 as medium, and a partial eta squared above 0.14 as large.

Results

Description of the groups

Descriptive statistics on gender, current employment status, age, IQ, and adult reading fluency of the RD and control group are presented in Table 1. The groups did not differ in the proportion of males or age at follow-up. Current unemployment was more common among the RD participants than among the controls.

Average reading fluency at adult-age was significantly lower in the RD group than in the control group. In the RD group, reading fluency of 29 participants (60.4%) was better than -1.5 SDs based on the test norm data, approaching an “adequate” level of reading skill. However, only three RD participants scored at or above the mean of the normative sample, and only one RD participant above the control group mean of reading fluency.

Average IQ was higher in the control than the RD group. In the RD group, seven individuals (14.5%) had an IQ below 70 in the follow-up assessment, and ten participants' IQ had declined more than ten standard points from the childhood. When comparing the RD group without the seven individuals with low IQs to the control group, the significant group difference in reading fluency remained.

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The group difference regarding IQs was only found in the VCI (comprising subtests Vocabulary and Similarities), the RD group scoring averagely lower than the control group, while no difference was found in the PRI. The VCI of eleven RD participants had declined more than ten standard points from childhood, while only four PRI scores were more than ten points weaker than the childhood PIQ scores. Moreover, one participant in the present sample had particularly low IQ at adult follow-up, which was partially due to considerable test anxiety during the follow-up appointment. The possible effect of IQ on the results was taken into account by controlling adult-age IQ in the analyses, and by running post-hoc analyses in group comparisons without the one individual with low IQ at adult follow-up.

[Insert Table 1 here]

Differences in psychosocial wellbeing between the RD and the control group

Table 2 shows the results on the first research question. As can be seen, the scores indicating psychosocial wellbeing problems (depression, and problems in self-satisfaction and social functioning) were generally rather low, whereas the scores indicating good psychosocial wellbeing (self-esteem and persistence) were rather high in the groups. The RD and the control group did not differ in depression, self-satisfaction, self-esteem, persistence, or social functioning, and there were no gender-related differences. IQ had a significant effect only on the persistence score, and the observed power was .59.

[Insert Table 2 here]

Associations of psychosocial wellbeing with reading skills in the childhood RD group

To answer the second research question we first examined the bivariate correlations between the psychosocial wellbeing measures and adult-age reading fluency both in the RD and the control group. The correlations were examined in order to find out whether there is a possible

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association between adult-age reading and psychosocial wellbeing in the both groups or whether this association is specific to the RD group. Hence, the aim was to find out whether current reading skills were more strongly related to psychosocial issues in adults with the history of struggling with reading compared to adults without such problems. As Table 3 shows, the psychosocial wellbeing measures correlated significantly with each other in both groups, apart from the persistence and the depression measures, which did not correlate in the controls. However, adult-age reading fluency correlated with the five psychosocial wellbeing measures and with unemployment only in the RD group. In addition, unemployment correlated with social functioning and self-satisfaction only in the RD group. When the one individual with particularly low IQ at adult follow-up was removed from the sample, the correlations between psychosocial wellbeing measures, reading skills, IQ and unemployment did not change substantially, still varying from .05 to .68. No significant correlations were found in the control group. Hence, only the RD group was included in the analyses pertaining to the second research question. In the RD group, a significant positive correlation was found between persistence and adult-age IQ. The severity level of childhood RD in the RD group did not correlate significantly with the psychosocial wellbeing measures or with adult-age fluency, IQ or unemployment.

[Insert Table 3 here]

Table 4 shows the results of the GLM analyses and bootstrapped confidence intervals pertaining to the associations between psychosocial wellbeing and the severity of childhood RD or adult-age reading skill, conducted in the RD group only. As can be seen, better adult-age reading fluency was associated with fewer depressive symptoms (observed power .69), with higher self-esteem (observed power .73), and better social functioning (observed power .64), but not with self-satisfaction or persistence in the RD group. The severity of childhood RD had no significant associations with any of the psychosocial

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wellbeing measures. Of the control variables, higher adult-age IQ was related to higher self-reported persistence (observed power .86), whereas gender and unemployment showed no associations with psychosocial wellbeing.

[Insert Table 4 here]

Discussion

We compared the psychosocial wellbeing of adults with childhood RD but without childhood comorbidities with that of their matched controls. We also examined whether the severity of childhood RD or adult-age reading fluency were related to psychosocial wellbeing in the childhood RD group, after controlling for adult-age IQ, gender, and employment status. The RD group did not differ from controls in the psychosocial wellbeing measures (depression, self-satisfaction, self-esteem, persistence, and social functioning) and there were no gender-related differences. In the RD group, no associations were found between the severity of childhood RD and the psychosocial wellbeing measures. Adult-age reading skill, however, was associated with psychosocial wellbeing.

Our finding that adults with RD did not differ from controls in psychosocial wellbeing conflicts with many earlier studies reporting an association between RD and psychosocial wellbeing problems in adulthood (e.g., Carawan et al., 2016; Undheim, 2003, for a review see Livingston et al., 2018). However, most of the earlier adult-age findings lack a longitudinal perspective on RD. Our results, for a sample of adults with a documented history of childhood RD, showed that childhood RD itself is not necessarily related to adult-age psychosocial wellbeing problems, whereas reading fluency problems that continue into adulthood may have a negative impact on psychosocial wellbeing.

Esser and colleagues (2002), Maughan and Hagell (1996) and Undheim (2003) also examined follow-up samples of adults diagnosed with RD in childhood. Contrary to our

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results, they found a higher proportion of psychiatric problems among the RD group compared to matched controls. Participant ages at childhood diagnosis and at follow-up resembled those in our study (8 and 25, 10 and 27-28, and 10 and 23 years, respectively). However, each study used population-based samples whereas we studied a sample of former clinical clients. Two other follow-up studies of RD examining a clinical (Strehlow et al., 1992) and a boarding school sample (Schulte-Körne et al., 2003) instead of a population-based sample found no differences in adult psychiatric symptoms compared to controls, as was the case in our study. This could indicate that a clinical assessment in childhood is related to more positive adult outcomes in psychosocial wellbeing. This speculation is in line with Undheim's (2003) finding that the population-based RD group reported more depressive symptoms than another RD sample drawn from a psychiatric clinic.

A thorough assessment process in childhood may function as a short-term intervention and induce a positive effect in psychosocial wellbeing. In our sample, the assessment process comprised three to five appointments, including the initial family interview, neuropsychological assessments, feedback, and a counseling appointment with family and teachers. Each child also received special educational support both before and after the assessment process. In Finland, no diagnosis is required for a child to be eligible for special education: instead, it is provided based on the teacher's evaluation (see Björn, Aro, Koponen, Fuchs, & Fuchs, 2015). These participants may also have originated from particularly supportive environments, as the clinical assessment process requires active participation of both the family and the referring school personnel. Such supportive factors may have boosted the development of psychosocial wellbeing among the children. The participants might have come from families that place a high value on education and are willing to support their children in studying. In addition, the participants in this sample did not have substantial comorbid disabilities (i.e., did not meet the criteria set for disability, a z-

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score below -1.5 in mathematics or below -1 in psychological problems) besides RD in childhood, which may also have contributed to the relatively positive adult-age outcomes. Thus, our findings are best generalizable to a population having received diagnosis of RD and support during childhood, and not having considerable comorbid disabilities.

Our longitudinal data enabled us to study both childhood and adult-age reading skills in relation to adult-age psychosocial wellbeing, associations that few earlier studies have examined (Schulte-Körne et al., 2003). Although we found no association between the severity of childhood RD and adult-age psychosocial wellbeing, our results showed that childhood RD matters when reading fluency problems continue into adulthood. It is plausible that improved reading skills enhance adult-age psychosocial wellbeing, or that psychosocial wellbeing helps improve reading.

Unexpectedly, gender did not explain variance in psychosocial wellbeing. This result conflicts with earlier observations that symptoms of depression are more common among women in general (Kessler, 2003) and psychosocial wellbeing problems more common among RD women (Maughan & Hagell, 1996) than RD men. The possible reason for their better-than-expected wellbeing may be that the women had received more support than women in general during their lives, beginning from the early clinical assessment process in childhood.

Hence, the clinical nature of our data needs to be considered when interpreting the results. In addition, while the attrition rate was reasonable (26%) for a longitudinal study and participants and non-participants did not differ in the childhood measures, attrition may have induced bias in the findings: adults with major issues in psychosocial wellbeing may not have participated in the follow-up. Moreover, as we excluded individuals meeting the criteria for mathematical disability or psychological problems and thus focused on rather pure RD, the sample size is small, owing to which the statistical power of most of the tests was rather low.

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Psychosocial wellbeing should also be examined more thoroughly in relation to comorbid LDs or to different types of LD (e.g., Klassen, Tze, & Hannok, 2011). However, our study aimed to gain knowledge on the wellbeing of individuals without comorbidity in childhood. The present sample of “pure” RDs formed one fourth of the original sample with RD in childhood which indicates that comorbidity of reading, math disability and psychological problems is common. The present findings should be interpreted with the original aim and design of the study in mind.

To better understand the implications of childhood RD on psychosocial wellbeing, other childhood factors possibly related to RD would also have been interesting to look at. Due to excluding children with substantial psychological problems in childhood from this sample so as to make it as homogenous as possible, the variance in childhood psychosocial wellbeing was small and hence, we did not have the chance to examine its effect on RD or on adult-age wellbeing. Also, we could not examine the relation of, e.g., school career with adult-age outcome among the present sample, nor compare childhood reading skills between the RD group and the controls, as the control group lacked childhood reading data.

Despite the association between adult-age reading fluency and psychosocial wellbeing, it should be noted that the variance in psychosocial wellbeing measures was generally low: in the measures indicating good psychosocial wellbeing (self-esteem and persistence), the scores were generally rather high, and in the problem scores (depression and problems in self-satisfaction and social functioning), none of the participants reported mental health problems that would need, e.g., medical treatment. The measures of psychosocial wellbeing problems that we used in the present study are primarily targeted at clinical practice and at detecting substantial problems in mental health, and hence the threshold for scores indicating problems are high. Even minor problems in psychosocial wellbeing can still have a considerable effect on everyday life, which is why subtle differences are also worth

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taking into account. However, the results pertaining to psychosocial wellbeing should also be interpreted carefully because of rather low reliability of some of the self-rating measures, which might indicate that among the present sample, some questions may have had wider variation than others. In addition, in some of the measures, the mean values and variances for the sum scores of all questions were considerably low. Still, higher reliabilities had been reported in the normative data of the measures. Further research is needed to find out which items or features best produce differences between groups. Also, it should be recognized that self-report measures are not equivalent to clinical diagnosis.

The descriptive statistics concerning unemployment should be interpreted with caution: we only examined current unemployment gained from the participants' interviews, because of the lack of reliable information on employment history, e.g., on the length of unemployment periods during lifetime. However, according to the results based on comprehensive register data on a larger sample of the clinical clients, a significantly higher share of the participants with RD than that of the control group had been unemployed for more than a year during lifetime (Aro et al., 2018). This confirms the figures of higher unemployment among the RD participants that we found in the present sample.

It should also be noted that a considerable proportion of our RD participants had rather low IQs at adult-age, and that the decline in the full scale IQs was mainly due to deteriorated verbal skills. Although the usage of different Wechsler test batteries must be taken into account when comparing the childhood and adult-age IQs, this finding may reflect the reciprocal long-term association of reading problems with verbal skills in particular which has been reported in earlier research (e.g., Ingesson, 2015; Stanovich, 1986; Swanson, 2012); weak reading skills and consequential minor exposure to text may diminish vocabulary and verbal skills in the long run. This is in line with our finding that adult-age reading fluency of the individuals with low IQs was also lower than that of the rest of the RD group. Finally, it

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should be noted that the adult-age IQ estimate used in the present study was based on an abbreviated battery of the WAIS IV, with only two verbal and two perceptual subtests included, which is why the results concerning IQ should be considered cautiously.

The results of our follow-up study suggest that childhood RD per se does not necessarily impact adult-age psychosocial wellbeing. This partially clarifies the contrasting findings of earlier longitudinal studies reporting associations between childhood RD and adult-age psychosocial wellbeing but which have not controlled for adult-age reading skills. Our results suggest that the extent to which reading problems continue into adulthood might be critical for psychosocial wellbeing among individuals with RD. This finding supports a focus on early assessment, special educational support and interventions in childhood, the importance of which has also been emphasized in earlier research (e.g., Partanen & Siegel, 2014; for a review see Livingston et al., 2018), as improved reading fluency may be an advantage in life to individuals with RD. In addition, it is reasonable to argue that some RD children need emotional support, continuing into adolescence and adulthood, to buffer against later problems in psychosocial wellbeing. As earlier research has suggested, interventions that combine both academic skill training and emotional support would best benefit most individuals with RD (for a review see Livingston et al., 2018). However, to identify the children who mostly need help and to support them more adequately, more in-depth research on the factors that boost psychosocial wellbeing is needed. This means applying a more holistic approach that includes the individual's developmental history and present-day functioning in various domains (cognitive, social, emotional, educational and environmental). This is necessary to better understand the factors that along with RD influence and shape various individual pathways.

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Conflicts of interest

The authors have declared no conflicts of interest.

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Table 1. Descriptive statistics on gender, current employment status, age, IQ, and adult reading fluency of the RD and control group.

	RD (n=48) ^a			Control (n=37)/Population ^b			<i>F</i> (1, 83)	η^2 ^c
	Range	Mean	SD	Range	Mean	SD		
Males (%)	62.5 %			62.2%				
Unemployed currently	20.8%			8.1%				
Age follow-up	20-39	26.23	4.75	21-40	27.51	4.79	1.52	.02
Age childhood	8-13	10.68	1.36	-	-	-		
IQ follow-up (WAIS)	49-112	86.08	15.29	70-120	95.95	12.63	10.09**	.11
Verbal Comprehension Index (VCI)	53-118	83.90	16.40	68-122	95.78	11.93	13.79**	.14
Perceptual Reasoning Index (PRI)	50-128	98.94	17.26	59-124	99.14	15.40	0.00	.00
Reading fluency follow-up	-3.49-0.44	-1.56	1.05	-2.36-1.95	0.31	0.88	75.99**	.48

Note. ^an =31 in maternal education. ^bIn maternal education, educational distribution in 30-54-year-old population in year 2000 (Official Statistics of Finland, 2018) serves as a control group. ^c η^2 = Effect size, partial eta squared. Reading fluency follow-up = Adult-age reading fluency; z-score mean of three reading fluency measures in the individual test battery on reading and spelling skills for adolescents and adults (Nevala, Kairaluoma, Ahonen, Aro, & Holopainen, 2006).

***p* < .01.

Table 2. Group and gender comparisons between the RD and the control group in depressive symptoms, self-satisfaction, self-esteem, persistence and social functioning.

	Group				Gender				IQ		
	$F(1; 81)^a$	M(SD) RD / Control	η^{2b}	95 % CI ^c	$F(1; 81)^a$	M(SD) male/female	η^{2b}	95 % CI ^c	$F(1; 81)^a$	η^{2b}	95 % CI ^c
Depression	.07	3.57(3.24) / 3.05(2.99)	.00	-1.22 – 1.69	.14	3.21(3.13) / 3.55(3.14)	.00	-1.55 - 0.92	1.90	.02	-.08 - .01
Self-satisfaction	.71	2.88(1.84) / 2.33(1.90)	.01	-.47 – 1.22	.20	2.56(2.05) / 2.78(1.56)	.00	-.99 - .68	1.61	.02	-.04 - .01
Self-esteem	2.78	14.66(2.61) / 13.49(4.03)	.03	-.37 – 3.16	.16	14.04(2.99) / 14.31(3.89)	.03	-1.80 – 1.20	.25	.00	-.03 - .06
Persistence	.91	29.73(5.59) / 29.43(5.87)	.01	-1.34 – 3.83	.04	29.79(5.43) / 29.28(6.14)	.00	-2.43 – 3.14	4.86*	.06	.01 - .18

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Social functioning	1.24	8.90(4.52) / 7.54(4.51)	.02	-.97 – 3.34	.66	8.60(4.84) / 7.81(4.03)	.01	-.08 - .05	.26	.00	-.08 - .05
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Note. Depression = Self-ratings in the BDI –II, total score (0-63). Self-satisfaction = the sum score of the 4 items in the Psychological wellbeing domain of the CORE-OM, reversed scale (0-16). Self-esteem = Rosenberg self-esteem scale, abbreviated, the sum score of all items (0-20). Persistence = Connor-Davidson Resilience Scale -10 (CD-RISC-10), the sum score of all items (0-40). Social functioning = the sum score of the 12 items in the Functioning domain of the CORE-OM, reversed scale (0-48).

^a degrees of freedom 1; 79 in BDI, and 1; 80 in Self-satisfaction and Self-esteem

^b η^2 = Effect size, partial eta squared.

^cBootstrapped confidence intervals with 1 000 samples.

* $p < .05$.

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Table 3. Pearson correlations of psychosocial wellbeing measures with adult-age reading fluency, IQ, and unemployment in the RD group (above the diagonal) and the control group (below the diagonal), and with the severity level of childhood RD in the RD group.

Variable	Control (n=37)		RD (n=48)						
	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Depression	—	.67**	-.37**	-.37*	.57**	-.47**	-.15	.28	.24
2. Self-satisfaction	.33*	—	-.40**	-.34*	.76**	-.41**	-.13	.37*	.27
3. Self-esteem	-.55**	-.48**	—	.53**	-.41**	.41**	.18	-.16	-.16
4. Persistence	-.31	-.30	.54**	—	-.28	.34*	.41**	-.23	-.17
5. Social	.40*	.54**	-.43**	-.39*	—	-.44**	-.13	.36*	.14
6. RF (ad)	-.12	-.11	.03	.10	-.02	—	.07	-.33*	-.28
7. IQ	-.24	-.19	-.07	-.02	.09	.28	—	-.09	.09
8. Unemployment	-.21	-.27	.24	.16	-.37*	-.15	-.27	—	-.01
9. RD (child)									—

Note. Depression = BDI –II total score. Wellbeing = CORE-OM Psychological wellbeing score. Social = CORE-OM Functioning score. Self-esteem = Rosenberg self-esteem scale, abbreviated. Persistence = Connor-Davidson Resilience Scale -10 (CD-RISC-10). RF(ad) = Adult-age reading fluency; z-score mean of three reading fluency measures. IQ = Full scale intelligence quotient (WAIS-IV, abbreviated, Wechsler, 2008; Finnish standardization). Unemployment: dichotomous variable for working situation: 1 – unemployed, 0 – not unemployed. RD (child) = severity level of childhood RD, based on the z-score of reading speed in either of two reading fluency tests commonly used at the clinic. As the two tests were not commensurable, a dichotomous measure for childhood reading skill was used. 1 “RD” (-2.5sd to -1.5sd), 2 “severe RD” (below -2.5sd).
* $p < .05$; ** $p < .01$.

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Table 4. GLM analyses and bootstrapped confidence intervals for the relations of each psychosocial wellbeing measure in the RD group with adult-age reading fluency and the level of severity of childhood RD, with IQ, gender, and unemployment as control variables.

	Depression			Self-satisfaction			Self-esteem			Persistence			Social functioning		
	F^a	η^{2b}	CI ^c	F^a	η^{2b}	CI ^c	F^a	η^{2b}	CI ^c	F^a	η^{2b}	CI ^c	F^a	η^{2b}	CI ^c
RF (ad)	5.41*	.12	-2.07 - -.09	2.67	.06	-1.00 - .13	7.82**	.16	.30 - 1.90	3.22	.07	-.20 - 3.29	5.60*	.12	-3.08 - -.04
RD (ch)	1.18	.03	-2.73 - .86	2.24	.05	-1.81 - .37	.13	.00	-1.32 - 1.81	.97	.02	-1.58 - 4.54	.12	.00	-2.98 - 2.39
IQ	.79	.02	-.09 - .03	.59	.01	-.04 - .02	1.76	.04	-.02 - .08	9.80**	.19	.03 - .28	.56	.01	-.10 - .03
G	.25	.01	-2.24 - 1.38	.04	.00	-1.11 - .92	3.46	.08	-3.12 - .14	.95	.02	-4.60 - 1.63	.74	.02	-1.08 - 3.58
Ue	1.07	.03	-3.94 - 1.47	3.87	.09	-2.68 - .46	.00	.00	-1.84 - 2.03	.63	.02	-2.44 - 5.55	2.63	.11	-5.26 - .25

Note. Depression = BDI –II total score. Self-satisfaction = CORE-OM Psychological wellbeing sum score. Self-esteem = Rosenberg self-esteem scale, abbreviated, sum score. Persistence = Connor-Davidson Resilience Scale -10 (CD-RISC-10), sum score. Social functioning = CORE-OM Functioning sum score.

RF (ad) = Adult-age reading fluency. RD (ch) = severity level of childhood RD. G = gender. Ue = unemployment.

^a degrees of freedom 1; 41.

^b η^2 = Effect size, partial eta squared.

^c Bootstrapped 95 % confidence intervals with 1 000 samples.

* $p < .05$, ** $p < .01$.