Indian J Pediatr (March 2012) 79(3):342–347
DOI 10.1007/s12098-011-0553-3

ORIGINAL ARTICLE

Prevalence of Specific Learning Disabilities Among Primary School Children in a South Indian City

Vijayalaxmi V. Mogasale · Vishwanath D. Patil · Nanasaheb M. Patil · Vittal Mogasale

Received: 11 December 2010 / Accepted: 29 July 2011 / Published online: 2 September 2011

Abstract
Objective To measure the prevalence of specific learning disabilities (SpLDs) such as dyslexia, dysgraphia and dyscalculia among primary school children in a South Indian city.
Methods A cross-sectional multi-staged stratified randomized cluster sampling study was conducted among children aged 8–11 years from third and fourth standard. A six level screening approach that commenced with identification of scholastic backwardness followed by stepwise exclusion of impaired vision and hearing, chronic medical conditions and subnormal intelligence was carried out among these children. In the final step, the remaining children were subjected to specific tests for reading, comprehension, writing and mathematical calculation.
Results The prevalence of specific learning disabilities was 15.17% in sampled children, whereas 12.5%, 11.2% and 10.5% had dysgraphia, dyslexia and dyscalculia respectively.
Conclusions This study suggests that the prevalence of SpLDs is at the higher side of previous estimations in India. The study is unique due to its large geographically representative design and identification of the problem using simplified screening approach and tools, which minimizes the number and time of specialist requirement and spares the expensive investigation. This approach and tools are suitable for field situations and resource scarce settings. Based on the authors' experience, they express the need for more prevalence studies, remedial education and policy interventions to manage SpLDs at main stream educational system to improve the school performance in Indian children.

Keywords Learning disability · Dyslexia · Dysgraphia · Dyscalculia · Scholastic backwardness

Abbreviations

SpLDs	Specific learning disabilities
IQ	Intelligence quotient

Introduction

Poor school performance or 'scholastic backwardness' is estimated to affect one in every five school children in India [1]. Specific Learning Disabilities (SpLDs) are recognized as an important cause for the scholastic backwardness even though many other reasons, such as, below average intelligence, vision and hearing impairment, chronic medical and mental disorders, emotional problems and poor socio-cultural environments are suggested [2]. It is reported that children with SpLDs felt different from the rest, tormented by the peers and suffered neglect from the teachers [3]. Undetected and unmanaged SpLDs results in chronic scholastic backwardness ensue school drop-outs [1, 4], emotional and behavioral problems such as depression [5], substance abuse and social delinquency [6–8]. It also

V. V. Mogasale (✉) · V. D. Patil
Department of Pediatrics, J N Medical College,
Belgaum 590010, India
e-mail: vijivittalmogasale@gmail.com

N. M. Patil
Department of Psychiatry, J N Medical College,
Belgaum, India

V. Mogasale
School of Population Health, University of Queensland,
Herston, QLD, Australia

V. V. Mogasale · V. Mogasale
International Vaccine Institute,
Seoul, South Korea

causes anxiety and stress in parents and affects quality of life in the family [9, 10]. The interference of an individual's emotional status, self esteem, behavior and capacity for economical independence eventually affects the overall wellbeing of the society significantly.

The SpLDs are mainly classified into three categories based on the specific aspect of learning components involved. Dyslexia refers to the problem in reading and comprehension, while dysgraphia is difficulty in expressive writing or repeated errors in spelling and grammar, whereas dyscalculia indicates trouble in the mathematical calculations. The SpLDs can be diagnosed only if one or more of above three learning components are affected significantly and persistently despite the conventional schooling, intact hearing and vision, normal intelligence, proper motivation and adequate socio-cultural opportunity [11–13].

The studies to measure prevalence of SpLDs in India are scanty and its importance is under recognized [14]. The true prevalence of the problem remains disputable among the scholars due to variable diagnostic criteria and measurement tools [4, 15, 16]. The published prevalence studies in India are decades old, mostly use convenient sampling methodology and geographically non-representative which limits its generalisability. To replenish the knowledge gap, the authors have conducted a study to measure the prevalence of SpLDs associated with scholastic backwardness among primary school children aged 8–11 y. This narrow age group was selected because SpLDs cannot be diagnosed conclusively before the age of 8 y due to higher plasticity of central nervous system in early ages and the management should be started before the age of 10 y to get maximum benefit [7, 15]. The present study geographically represents the children studying in third and fourth standard in Belgaum, a South Indian city.

Material and Methods

Sampling

A cross-sectional study was designed using multi-staged stratified randomized cluster sampling methodology. Ethical clearance for the study was obtained from the Jawaharlal Nehru Medical College Institutional Ethical Committee on human subjects. The list of primary schools and permission for the study were obtained from the Deputy Director of Public Instruction of Belgaum city. All the schools in the city which followed state syllabus in 2007–08 were geographically stratified into four sectors namely northeast, northwest, southeast and southwest. Based on the number of schools in each geographical sector, proportional samples of schools were drawn randomly. One batch each from third and fourth standard was selected randomly from these schools followed by a cluster sampling of all the children in that batch. Each batch was expected to have an average of 50 students. This overall sampling procedure ensures the geographical representation of Belgaum city. Based on the assumed SpLD prevalence of 15% from the literature, sample size is calculated at 5% significance level and 20% allowable error with a design factor of 2 for cluster sampling as per the formula shown in Appendix. The estimated sample size was 1134.

Identification of SpLDs

The basic socio-demographic information about the sampled children from third and fourth standard was collected initially. In addition, parental education, occupation and socio-economic status information were obtained. Further, the sampled children were subjected to a six level serial screening procedure to identify SpLDs (Fig. 1).

At screening level one, scholastic backwardness was identified if the sampled children fell under either of the two criteria's. First criterion was the global impression of the class teacher on the child's scholastic backwardness which was verified with objective questionnaire using Rutters proforma A [17]. Teachers' opinion was important as they are in best position to comment about academic performance [18]. Rutters proforma uses a simple questionary method to measure academic performance objectively and excludes teachers' bias, if any. The proforma is easy to understand and can be administered by a social worker with minimum training. Second criterion was review of academic record to ascertain poor grades (C or C+) in two consecutive examinations. Screening levels 2, 3 and 4 were used to exclude children with health conditions such as impaired vision (diagnosis based on Snellens charts), impaired hearing (diagnosis based on clinical hearing tests) and severe physical conditions (diagnosis based on clinical examinations) [2] that may interfere their school performance. Screening level 5 was used to exclude children with sub-normal intelligence based on Seguin Form Board test [19]. Only children with normal and above intelligence quotient (IQ) were included in the study, as SpLDs cannot be labelled in children with sub-normal intelligence [11–13]. Seguin Form Board test is simple to administer, less time consuming and more suitable for IQ screening for the targeted age group. An IQ of 90 measured for chronological age using J. B. Raj norms was considered cut off for normal. At the end, all remaining children were subjected to reading, writing and mathematical performance screening in the respective medium of school instruction (Kannada and English) using SpLD battery test developed and validated by National Institute of Mental Health and Neuro Sciences [20] for the field situation. These screening tests have defined criteria for the identification of dyslexia, dysgraphia and discalculia.

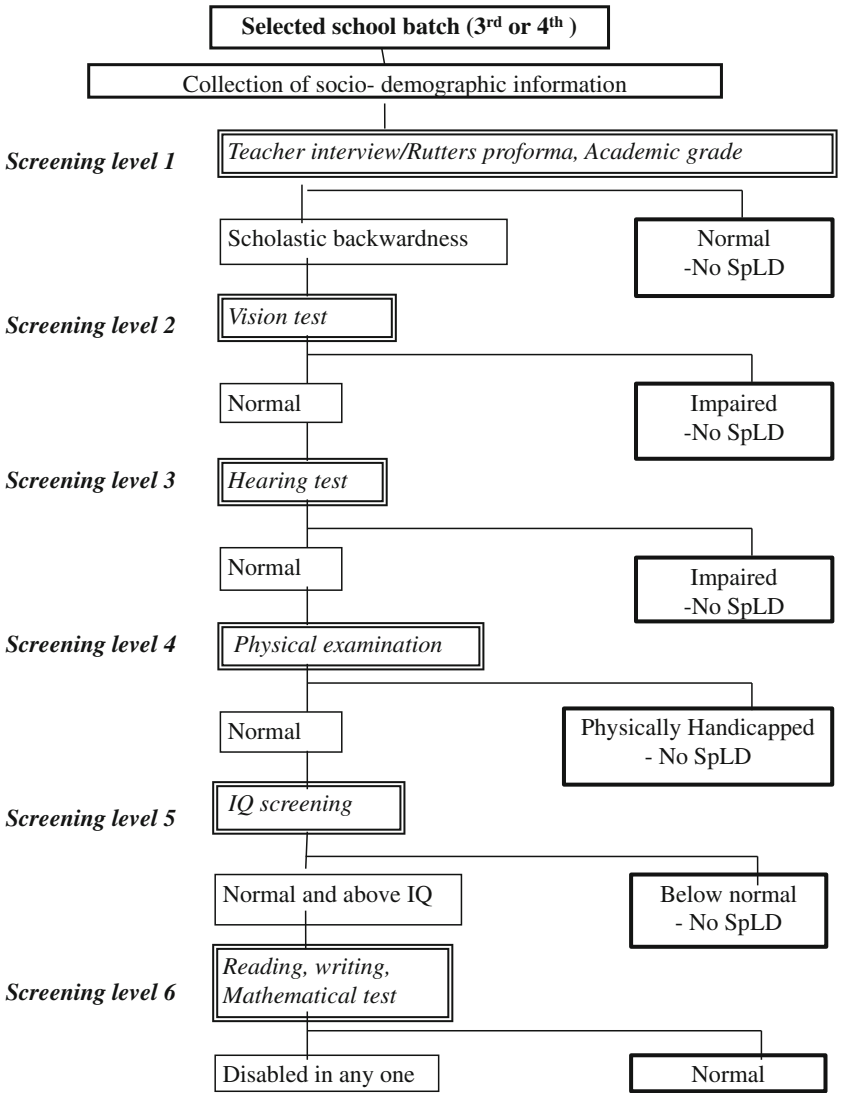

Fig.1 Flowchart for screening tests to identify SpLDs

Three follow-up visits were made to cover those children who missed the screening procedure. All the screenings except level 5 were conducted by a pediatric postgraduate also trained in administering SpLD battery test. Screening level 5 was conducted by an experienced clinical psychologist. A trained social worker assisted at screening level 1 and 6.

Results

A total cross-sectional sample of 1,101 children was collected from five public and six private schools of Belgaum city using multi-staged stratified randomized cluster sampling method. A total of 13 (1.2%) children were absent during the tests (vision test = 7 and IQ test = 6) (Fig. 2). In addition, dyslexia in nine children and dysgraphia in six children could not be identified as they had inconclusive results. The data analysis was conducted using Stata version 9.2 [21].

Sample Characteristics

The sample proportionally represented all four geographical sectors with highest from north east sector (Table 1). Majority of the sampled children studied in Kannada medium (70%) and in private schools (60%). Boys (63%) outnumbered girls with equal number of children from third and fourth standards. Mean age of children was 8.75 y. Kannada was mother tongue for half of the children (54%), while Marathi was 14%, whereas the rest spoke Telugu, Urdu, Tamil or Hindi. As per the modified BG Prasad socio-economic status classifications adjusted for 2007, most sampled children fell under class 2, 3 and 4 [22, 23]. Majority of parents were

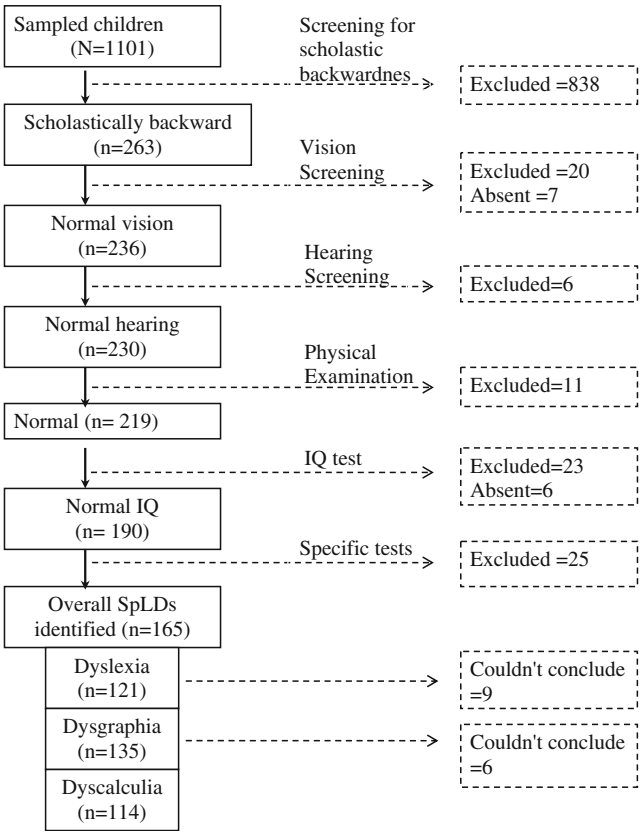

Fig. 2 Flowchart for screening test results

Table 1 Socio-demographic features of sampled children

Variables	Subtypes	Number (*N*=1101) (%)
Geographical distribution	North east	387 (35.15)
	North west	324 (29.43)
	South east	214 (19.14)
	South west	176 (15.99)
Sex	Male	693(62.94)
	Female	408 (37.06)
Sector	Public	438 (39.78)
	Private	663 (60.22)
Medium (language)	Kannada	774 (70.30)
	English	327 (29.70)
Class	Third	552 (50.14)
	Fourth	549 (49.86)
Mother tongue	Kannada	586 (53.22)
	Marathi	154 (13.99)
	Others	338 (30.70)
	Missing[a]	23 (2.09)
Socio-economic status (modified BG Prasad classification)	Class 1	131(11.89)
	Class 2	255 (23.16)
	Class 3	240 (21.80)
	Class 4	335 (30.43)
	Class 5	40 (3.63)
	Missing[a]	100 (9.08)

[a] Data could not be collected for missing cases

educated, high school or above (Table 2). Half of the fathers were unskilled workers like laborers, whereas most (85%) of the mothers were housewives.

Prevalence of SpLDs

About 24% (*n*=263) of children were found to be scholastically backward (Fig. 2). Among them 59% (*n*=155) were identified based on Rutter's proforma and 32% (*n*=84) were identified by both Rutter's proforma and academic grading. Only 9% (*n*=24) of the scholastically backward children were identified by poor academic grades. Out of total 1,101 children, 1.8% (*n*=20) had vision impairment, 0.5% (*n*=6) had hearing impairment, 1% (*n*=11) had physical disability and 2% (*n*=23) had subnormal IQ that would have affected their learning ability. These children were excluded at different level of screening procedure. Some children (*n*= 13) missed screening tests even after three additional visits were excluded as they remained absent on visiting days or left the school in between. Finally, a total of 165 children were diagnosed with one or more SpLDs after exclusion of children with inconclusive results for specific tests.

The overall prevalence of specific learning disability was 15.17% (*n*=165) (Fig. 3). Among them, dysgraphia was the most frequent (12.48%; *n*=135) followed by dyslexia (11.21%; *n*=121) and dyscalculia (10.48%; *n*=114). In total, 7% (*n*=76) children had all three types of SpLDs namely dyslexia, dysgraphia and dyscalculia.

Discussion

The present study measured SpLDs prevalence of 15.17% which is at the upper end of generally believed range of 2% to 18% in India [16, 24–27] and 5% to 17% in worldwide [4, 28]. The individual prevalence of 11.2%, 12.5% and 10.5% respectively for dyslexia, dysgraphia and dyscalculia converged towards the peak of reported range in India which extends from 2% to 18% for dyslexia, 8% to 14% for dysgraphia and 3% to 18% for dyscalculia [16, 24–27]. Large sample size and uniqueness in the present study design confer more confidence in the outcome. The present study covers 1,101 children comprising of 11 schools from different settings. The multi-staged stratified randomized method used in the study eliminates the biases due to convenient sampling in previously published Indian studies [24, 25] making it geographically more representative and denoting sectors and language to a certain extent. It favors deduction of comparable prevalence of SpLDs in similar

Table 2 Education and occupation of parents of sampled children

Variable	Level/type	Father (*N*=1101) (%)	Mother (*N*=1101) (%)
Education	Illiterate	77 (7.72)	128 (12.80)
	Primary	76 (7.62)	106 (10.60)
	Higher primary	189 (18.96)	248(24.80)
	High school	378 (37.9)	347 (34.70)
	Pre university	150 (15.05)	105 (10.50)
	>Pre university	127 (12.74)	66 (6.60)
	Missing[a]	104 (9.45)	101 (9.17)
Occupation	Professional	49 (4.98)	39 (3.84)
	Permanent job	163 (16.58)	16 (1.58)
	Business	192(19.53)	10 (0.99)
	Skilled	66 (6.7)	11 (1.08)
	Unskilled	509 (51.78)	72 (7.09)
	Unemployed/house wife	4 (0.41)	867(85.42)
	Missing[a]	118 (10.72)	86 (7.81)

[a]Data could not be collected for missing cases

cities across India facilitating the policy decisions and advocacy efforts for conducting interventions.

The present study shows utility of practical approaches at school level to detect SpLDs using simplified screening procedure and tools while minimizing time, expensive investigation and specialist requirements. The diagnosis of SpLDs is considered complex requiring a multi-disciplinary team of experts such as pediatric neurologists and child psychiatrists to rule out various exclusion criteria [13]. The authors' experience was that involving school teachers and trained social workers curtailed the time needed by medical personnel and clinical psychologist, and saved the precious time required from other experts which is scarce in resource limited settings. In a simplified stepwise screening, a large number (76%) of children were screened at level one, as they were not scholastically backward giving less screening load (24%) to medical expert and still lesser load (20%) to clinical psychologist. The importance of this simple approach cannot be undermined in identification and management of large number of SpLD children in India. The authors acknowledge that the present study identifies only those SpLDs which are severe enough to cause scholastic backwardness while lesser ones were excluded. Nevertheless, it is important to focus on identification of children with severe SpLDs who may be benefitted maximum from the intervention. Study does not screen scholastic backwardness due to emotional deprivation and poor motivation which may have misclassified small proportion of children into SpLDs. The present tools could be different from other studies and may differ in sensitivity for different languages which limit the comparability. However, it is a problem not confined to this study alone and difficult to address.

A total of 13 children (1.1%) missed the screening tests as they either did not attend the school on screening day or left the school. It would have under-or over-estimated the prevalence depending upon missed children who had SpLDs or not. However, as the number of missed children are very low, it is unlikely to have a big impact on the results. The authors could not conclude dyslexia (9/165= 5.5%) in nine children and dysgraphia (6/165=3.6%) in six children because of their language barrier which might have under-estimated their prevalence.

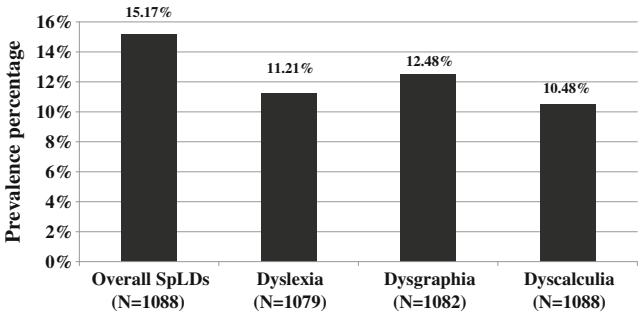

Fig. 3 Prevalence of specific learning disabilities among sampled school children

Conclusions

In summary, nearly 15% of primary school children who are scholastically backward are affected by SpLDs in Belgaum, a South Indian city. All the three types of SpLDs namely; dyslexia, dysgraphia and dyscalculia are equally at higher side affecting more than 10% of school children. The present study has important ramifications to simplify the identification approaches, to advocate the need for planning

and developing public health interventions, and expanding educational policies. In a multi-linguistic country like India, more prevalence studies across the nation can fill the additional knowledge gap. Interventions at school including remedial education and teachers training along with building family and social support systems to affected children are very much needed efforts for this under addressed problem of SpLDs.

Acknowledgements The authors acknowledge the support by children and teachers of various schools in conducting this study, inputs from various faculty members of J.N. Medical College, Belgaum including Dr. N.S. Mahantshetti, Head of Department of Pediatrics during the progress review and Mr. Mohammad for support in the field. The authors specially thank Mr. R.S. Hegde, Clinical Psychologist for his contributions in conducting IQ tests and Mrs. Chandana Billur for helping in the procedure. The authors acknowledge the contributions from the faculty members of Department of Psychiatry and Psychology, National Institute of Mental Health and Neuro Sciences for providing training and tools.

Contributions VVM: Conducted the study and drafted the manuscript; VDP: Conceptualized the study, contributed as a principal guide and reviewed the manuscript; NMP: Contributed as a co-guide and reviewed the manuscript; VM: Study design, statistical analysis, and revised the manuscript. All authors have approved the final manuscript.

Conflict of Interest None.

Role of Funding Source None.

Appendix

$$n = \frac{4pqD}{d^2}$$

p: prevalence of learning disability (15%); q: (100-p); d: allowable error 20% of p; D: design factor (2)

References

1. Thacker N. Poor scholastic performance in children and adolescents. Indian Pediatr. 2007;44:411–2.
2. Karande S, Kulkarni M. Poor school performance. Indian J Pediatr. 2005;72:961–7.
3. Karande S, Mahajan V, Kulkarni M. Recollections of learning-disabled adolescents of their schooling experiences: a qualitative study. Indian J Med Sci. 2009;63:382–91.
4. Lyon GR. Learning disabilities. Future Child. 1996;6:54–76.
5. Wright-Strawderman C, Watson BL. The prevalence of depressive symptoms in children with learning disabilities. J Learn Disabil. 1992;25:258–64.
6. Karande S, Mehta V, Kulkarni M. Impact of an education program on parental knowledge of specific learning disability. Indian J Med Sci. 2007;61:398–406.
7. Shaywitz SE. Dyslexia. N Engl J Med. 1998;338:307–12.
8. Winters CA. Learning disabilities, crime, delinquency, and special education placement. Adolescence. 1997;32:451–62.
9. Karande S, Kumbhare N, Kulkarni M, Shah N. Anxiety levels in mothers of children with specific learning disability. J Postgrad Med. 2009;55:165–70.
10. Karande S, Kulkarni S. Quality of life of parents of children with newly diagnosed specific learning disability. J Postgrad Med. 2009;55:97–103.
11. Kulkarni M, Kalantre S, Upadhye S, Karande S, Ahuja S. Approach to learning disability. Indian J Pediatr. 2001;68:539–46.
12. Hammill DD. On defining learning disabilities: an emerging consensus. J Learn Disabil. 1990;23:74–84.
13. Karande S, Kulkarni M. Specific learning disability: the invisible handicap. Indian Pediatr. 2005;42:315–9.
14. Crawford SG. Specific learning disabilities and attention-deficit hyperactivity disorder: Under-recognized in India. Indian J Med Sci. 2007;61:637–8.
15. Demonet JF, Taylor MJ, Chaix Y. Developmental dyslexia. Lancet. 2004;363:1451–60.
16. Ramaa S. Two decades of research on learning disabilities in India. Dyslexia. 2000;6:268–83.
17. Rutter M. Children's behavior questionnaire for completion by teachers; preliminary findings. J Child Psychol Psychiatr. 1967;8:1–11.
18. Narayanan J. Grade level assessment device for children with learning problem in schools (GLAD) Secunderabad: National Institute for the Mentally Handicapped (NIMH); 1997.
19. Goel SK, Bhargava DM. Handbook for Seguin Form Board. Agra: National Psychological Corporation; 1990.
20. Hirisave U, Oommen A, Kapur M. Psychological assessment of children in the clinical setting. Bangalore: National Institute of Mental Health & Neurosciences; 2002.
21. Stata/SE 9.2 for Windows [computer program]. TX 77845 USA: StataCorp LP; 2007.
22. Prasad B. Social classification of Indian families. J Indian Med Assoc. 1968;51:365–6.
23. Prasad B. Changes proposed in Social classification of Indian families. Indian Med Assoc. 1970;55:198–9.
24. Mittal SK, Zaidi I, Puri N, Duggal S, Rath B, Bhargava SK. Communication disabilities: emerging problems of childhood. Indian Pediatr. 1977;14:811–5.
25. Shah BP, Khanna SA, Pinto N. Detection of learning disabilities in school children. Indian J Pediatr. 1981;48:767–71.
26. Ramaa S, Gowramma IP. A systematic procedure for identifying and classifying children with dyscalculia among primary school children in India. Dyslexia. 2002;8:67–85.
27. Agarwal KN, Agarwal DK, Upadhyay SK, Singh M. Learning disability in rural primary school children. Indian J Med Res. 1991;94:89–95.
28. Shaywitz SE, Shaywitz BA. Dyslexia (specific reading disability). Biol Psychiatry. 2005;57:1301–9.