EVIDENCED BASED PRACTICAL GUIDELINES FOR DIAGNOSIS AND TREATMENT IN READING AND SPELLING DISORDER: A FURTHER STEP FOR HIGH QUALITY STANDARDS IN INTERVENTION AND DIAGNOSIS

Gerd Schulte-Körne
The Diagnosis and Treatment of Reading and/or Spelling Disorders in Children and Adolescents

Katharina Galuschka, Gerd Schulte-Körne

www.aerzteblatt.de/int/archive/article/176275
BACKGROUND
DIAGNOSIS AND TREATMENT

- Diagnosis of reading and/or spelling disorder is inconsistent in medical and psychological/psychotherapeutic practice
- Different methodological approaches, diagnostic criteria, and testing methods
- Different treatment methods, several without evaluation or with evaluation only to an unsatisfactory degree
METHODS OF DEVELOPMENT CLINICAL GUIDELINES

COMPREHENSIVE SYSTEMATIC LITERATURE SEARCHES OF SEVERAL DATABASES WERE UNDERTAKEN (PUBMED, PSYCINFO, ERIC, COCHRANE, CLINICALTRIALS.GOV, PROQUEST)

THE LITERATURE SEARCH INCLUDED ALL PUBLICATIONS UP TO AND INCLUDING APRIL 2015.
FIGURE 1

After screening titles and abstracts

305 hits

After viewing full text

21 RCTs for meta-analysis

52 publications in evidence table

Expert consultation

1 RCT

Evidence

Meta-analysis of 22 RCTs

53 publications in evidence table
EVIDENCE BASED AND CONSENTED GUIDELINES

- All included studies were evaluated with regard to their methodological quality by using the checklists of the Scottish Intercollegiate Guidelines Network (SIGN) and assigned an evidence level by using the scheme of the Oxford Center for Evidence Based Medicine.
- In a consensus meeting that was moderated by a neutral party, the participating specialty societies voted in a structured manner for each recommendation.
- Agreement of >95% was regarded as strong consensus, 75–95% as consensus, and 50–57% as majority agreement.
Participating organizations

• Publishers: AWMF= Association of the Scientific Medical Societies in Germany (AWMF):
  - German Association for Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy (DGKJP)

• Other participating organizations:
  - Professional Association of Children’s and Young People’s Physicians (bvkj)
  - Professional Association of Child and Adolescent Psychotherapists (bijk)
  - German Society of Child and Adolescent Psychiatry, Psychosomatics and Psychotherapy (BKJPP)
  - Professional and specialist association for vocational remedial teaching (BHP)
  - Federal Working Group of Clinical Directors for Child and Adolescent Psychiatry, Psychosomatics, and Psychotherapy (BAG)
  - Federal Chamber of Psychotherapists (BPkK)
  - Federal Association for Dyslexia and Dyscalculia (BVL)
  - Federal Association for behavioral therapy in children and adolescents (BVKJ)
  - German Society of Pediatrics and Adolescent Medicine (DGKJ)
  - German Society of Phoniatrics and Pediatric Audiology (DGPP)
  - German Psychological Society (DGPs)
  - German Society for Social Paediatrics and Adolescent Medicine (DGSPJ)
  - German Ophthalmological Society (DOG)
  - German Federal Association of Academic Language/Speech Therapists (dbS)
  - German Federal Association for Logopedics (dbl)
  - Germany’s Association of Occupational Therapists (DVE)
  - The German Society of Speech-, Language-, and Voice Pathology (DGSS)
  - Association for Integrative Learning Therapy (Fil)
  - German Society of Neuropsychology (GNP)
  - Association for special needs education (vds)
  - Association for analytical child and adolescent psychotherapists in Germany (VAKJP)
Overview of inclusion criteria according to the research question

Study inclusion criteria

Diagnostic evaluation of discrepancy to age/grade norms or IQ
1. Study comparing children and adolescents, whose diagnosis of reading and spelling disorder is based on the intelligence quotient (IQ) discrepancy criterion, and adolescents, in whom reading and spelling disorder was diagnosed on the basis of a discrepancy of age norms of their reading and/or spelling performance.
2. The study design is a systematic review, an analytical study, or a cross sectional study.

Testing method
1. German-language approach to capturing the relevant skill set (reading, spelling, phonological processing of information and naming speed, language skills, mathematical skills, arithmetical performance, auditory perception and processing, language/speech skills, attention).
2. Includes standard values that have been tested for appropriateness in the past 10 years.

Support
1. Controlled intervention study, that collected data on reading and/or writing skills before and after the intervention.
2. Study population consists of children and adolescents, whose reading and/or spelling performance was at least on or below the 25th percentile or who had been diagnosed with reading and/or spelling disorder.

Comorbidities
1. Prevalence study with epidemiological or selected samples that enabled prevalence estimates of comorbid attention deficit/hyperactivity disorder (ADHD), anxiety, depression, auditory processing and perception disorder, disorder of arithmetical skills and speech/language disorder in children and adolescents with reading and/or spelling disorder.
2. Selected samples had to consist of children and adolescents with reading and/or spelling disorder.
RESULTS
DIAGNOSTICS

For the diagnostic evaluation, three different diagnostic criteria are used in clinical practice that are based on the ICD-10, which yield different prevalence rates of the disorder:

- the age/
- grade
- intelligence quotient (IQ) discrepancy criterion.

No empirical evidence for different therapeutic effects, the course of the disorder, or heritability between children and adolescents for the differential use of the three criteria.

- None of the criteria is to be put to preferential use.
- One of the three criteria should therefore be used to base a diagnosis on.
# TABLE 1

## Diagnostic criteria conform to guideline recommendations

<table>
<thead>
<tr>
<th>Diagnostic criterion</th>
<th>Observed as</th>
<th>Expressed as</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age discrepancy criterion</td>
<td>Below average performance in the chosen testing method compared with age standard</td>
<td>At least percentile rank ≤ 16 or T value ≤ 40</td>
</tr>
<tr>
<td>Grade discrepancy criterion</td>
<td>Below average performance in the chosen testing method compared with standard grade performance; if available, use of school-type specific standard</td>
<td>At least percentile rank ≤ 16 or T value ≤ 40</td>
</tr>
<tr>
<td>Age or grade standard and intelligence discrepancy criterion</td>
<td>Below average performance in the chosen testing method compared with standard age or grade performance AND Unexpected poor performance in the chosen testing method compared with IQ</td>
<td>At least percentile rank ≤ 16 or T value ≤ 40 AND Discrepancy from respective T or IQ values ≥ 1 standard deviation</td>
</tr>
</tbody>
</table>
Central quality criteria for assessing tests

- The theoretical basis has been described in detail.
- The standard values are consistent with the relevant reference group or target group.
- The procedural instructions are formulated in such a way that different persons will be able to perform the procedures, evaluate them, and interpret them in comparable ways.
- The reliability was determined by using a retesting method.
- The way in which the validity was determined takes into account the diagnostic question and target group for the procedure.
- The standard sample per age range/standard time period was a minimum of 250 persons.
DIAGNOSIS

- In addition to the appropriate diagnostic instruments,
- a detailed developmental, family, and school history should be taken,
- a neurological and internal examination,
- an intelligence test,
- a differential diagnostic examination with the aim of excluding ocular vision disorders or auditory perception and processing disorders.
DIFFERENTIAL DIAGNOSIS-VISION

If children or adolescents report blurred vision, sudden/rapid-onset tiredness, and headaches after reading for prolonged periods, as well as an increase in symptoms during the course of the school day, an eye-related reading disorder should be considered, which can have different causes:

- Refractive anomalies (refractive error), hyperopia (farsightedness)
- Latent and intermittent strabismus (heterophoria)
- Hypo-accommodation (reduced ability for accommodation to near distance)
- Convergence insufficiency.
- 6.7% of a population of primary school children with reading and spelling disorder were found to have ocular problems that may have caused the reading difficulties.
- The recommended diagnostic approach is:
<table>
<thead>
<tr>
<th>History</th>
<th>Family-, patients’ own, ophthalmological and school history</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual acuity</td>
<td>Far distance/near distance, right/left eye/binocular, with/without correction</td>
</tr>
<tr>
<td>Eye position</td>
<td>Single cover test far distance/near distance, light/object</td>
</tr>
<tr>
<td>Eye mobility</td>
<td>With light or object</td>
</tr>
<tr>
<td>Convergence reaction</td>
<td>With object</td>
</tr>
<tr>
<td>Accommodation</td>
<td>Near-point convergence measurement: right/left eye, using small object</td>
</tr>
<tr>
<td>Fusional vergence amplitude</td>
<td>Free space, prisms</td>
</tr>
<tr>
<td>Stereopsis</td>
<td>TNO stereoscopic vision test/Lang test</td>
</tr>
<tr>
<td>Ocular findings</td>
<td>Anterior segments, retina, optic nerve</td>
</tr>
<tr>
<td>Refraction</td>
<td>Objective identification of a refractive error after accommodation has been blocked by medication (cycloplegia)</td>
</tr>
<tr>
<td>Spectacles</td>
<td>Establishing whether spectacles are being worn</td>
</tr>
</tbody>
</table>
DIFFERENTIAL DIAGNOSIS-HEARING

- An auditory disorder is to be regarded as relevant for speech where bilateral hearing loss (>25 dB in the ear with better hearing) has been present for more than three months or permanently in the main speech frequency range (between 500 and 4000 Hz).

- Even in low-grade hearing loss, schoolchildren display notable difficulties in distinguishing sounds, which is a basic condition for acquiring spelling/writing language skills.

- The guideline recommends the following methods for diagnosing hearing problems in schoolchildren:
  - Impedance audiometry with stapedius reflex measurement in order to assess the ventilation mechanism of the middle ear
  - Otoacoustic emissions to test auditory cell function
  - Determining hearing threshold levels by means of air and bone conduction.
INTERVENTION
Effectiveness of Treatment Approaches for Children and Adolescents with Reading Disabilities: A Meta-Analysis of Randomized Controlled Trials

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Abstract

Children and adolescents with reading disabilities experience a significant impairment in the acquisition of reading and spelling skills. Given the emotional and academic consequences for children with persistent reading disorders, evidence-based interventions are critically needed. The present meta-analysis extracts the results of all available randomized controlled trials. The aims were to determine the effectiveness of different treatment approaches and the impact of various factors on the efficacy of interventions. The literature search for published randomized-controlled trials comprised an electronic search in the databases ERIC, PsycINFO, PubMed, and Cochrane, and an examination of bibliographical references. To check for unpublished trials, we searched the websites clinicaltrials.com and ProQuest, and contacted experts in the field. Twenty-two randomized controlled trials with a total of 49 comparisons of experimental and control groups could be included. The comparisons evaluated five reading fluency trainings, three phonemic awareness instructions, three reading comprehension trainings, 29 phonics instructions, three auditory trainings, two medical treatments, and four interventions with coloured overlays or lenses. One trial evaluated the effectiveness of sunflower therapy and another investigated the effectiveness of motor exercises. The results revealed that phonics instruction is not only the most frequently investigated treatment approach, but also the only approach whose efficacy on reading and spelling performance in children and adolescents with reading disabilities is statistically confirmed. The mean effect sizes of the remaining treatment approaches did not reach statistical significance. The present meta-analysis demonstrates that severe reading and spelling difficulties can be ameliorated with appropriate treatment. In order to be better able to provide evidence-based interventions to children and adolescent with reading disabilities, research should intensify the application of blinded randomized controlled trials.

HTTP://JOURNALS.PLOS.ORG/PLOSONE/ARTICLE?ID=10.1371/JOURNAL.PONE.0089900
EFFECTIVENESS OF TREATMENT APPROACHES (GALUSCHKA ET AL. 2014)

- Phonics instruction is the most intensively investigated treatment approach and
- the only approach whose effectiveness on reading and spelling performance is statistically confirmed.

- the systematic instructions of letter-sound-correspondences as well as
- decoding strategies and
- the application of these skills in reading and writing activities
- is the most effective method for improving literacy skills of children and adolescents with reading disabilities.
Phonemic awareness trainings are widely recognised as being effective for the remediation of preschool children at risk for reading disabilities:

the results demonstrate that phonemic awareness interventions provided to school-aged children and adolescents with RD, there is no statistically significant effect.

Reading fluency trainings emphasize repeated whole word or text reading:

reading fluency training alone is not an effective way to enhance the reading and spelling skills of disabled readers.
EFFECTIVENESS OF TREATMENT APPROACHES (GALUSCHKA ET AL. 2014)

- **Reading comprehension training**: no significant influence on literacy achievement.
- **Irlen lenses**: no statistical significance for effectiveness.
- **Medication** with the nootropic piracetam: no statistical significance for effectiveness. Possibility of side effects, the risks seem to outweigh its benefits.
- **Auditory trainings**: not significantly improve children’s reading skills. It can be concluded that focussing on underlying causes could not be confirmed to date.
RECOMMENDATIONS BASED ON EVIDENCE

- Reading performance can best be developed by using the systematic instructions of letter-sound correspondences and letter-syllable- and morpheme synthesis ($g' = 0.32; 95\%$ confidence interval $[0.18; 0.47]$)

- Spelling performance is most effectively improved by using the systematic instructions of sound-letter correspondences, exercises analyzing sounds, syllables, and morphemes ($(g' = 0.34; [0.06; 0.61])$) and by applying a training procedure to enable the acquisition and generalization of orthographic regularities.

- Furthermore, the reading performance of children and adolescence with a reading disorder can be improved by presenting texts in large print ($\geq 14$ pt) and wider space between letters, words, and lines ($\geq 2.5$ pt).

- Reading materials for affected students should therefore be selected accordingly.
NO EVIDENCE FOR EFFECTIVENESS

- visual perception training
- neuropsychological hemisphere-specific stimulation training
- alternative approaches
  - homeopathy
  - acupressure
  - osteopathy
  - kinesiology
  - food supplements
  - visual biofeedback
  - motor exercises
  - occlusion therapy.
<table>
<thead>
<tr>
<th>Method</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemisphere-specific stimulation</td>
<td>Tachistoscopic presentation of different stimuli (words) in the left or right visual hemifield, in order to compensate in the respective cerebral hemisphere the correction of the word processing ability that is not correctly developed.</td>
</tr>
<tr>
<td>Irlen lenses</td>
<td>Colored spectacle lenses are worn for all reading activities, with the aim of filtering out disruptive wavelengths from the light spectrum, thus enabling easier reading.</td>
</tr>
<tr>
<td>Visual perception and processing training</td>
<td>Exercises to improve visual differentiation ability and gaze control, fixation and discrimination tasks. Visual perception is supported as the basis of successful written-language acquisition.</td>
</tr>
<tr>
<td>Auditory perception and processing training</td>
<td>Exercises to learn to distinguish pitch, volume, and rhythm and for directional hearing and differentiating sound sequences, with the aim of improving auditory perception as the basis of successful written-language acquisition.</td>
</tr>
<tr>
<td>Alternative medical methods</td>
<td>These include, for example, homeopathy, osteopathy, and kinesiology, as well as Bach flower therapy. The aim is to improve affected children’s ability to learn by eliminating psychological/biochemical imbalances or learning obstacles.</td>
</tr>
<tr>
<td>Food supplements</td>
<td>Ingestion of polyunsaturated fatty acids (ethyl-eicosapentaenoic acid [EPA]) in order to improve reading ability.</td>
</tr>
<tr>
<td>Occlusion treatment</td>
<td>One eye is covered up during reading activities, in order to improve binocular stability.</td>
</tr>
<tr>
<td>Motor exercises</td>
<td>Exercises to support body perception and coordination and to eliminate persistent neonatal reflexes.</td>
</tr>
</tbody>
</table>
RECOMMENDATIONS
## Reading Intervention

<table>
<thead>
<tr>
<th>Awareness of syllables and sounds</th>
<th>Reading accuracy</th>
<th>Reading fluency</th>
<th>Reading/text comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercises aiming to identify, categorize, segment, delete or discriminate syllables and sounds in words</td>
<td>Systematic instruction of grapheme-phoneme correspondences and exercises for phoneme synthesis</td>
<td>Systematic exercises for phoneme, syllable, and morpheme synthesis</td>
<td>If reading accuracy or speed are low: Instruction of grapheme-phoneme correspondences or systematic exercises for phoneme, syllable, morpheme synthesis. As a result of speech/language disorder: Interventions to increase vocabulary repertoire and competencies in terms of syntax and grammar</td>
</tr>
</tbody>
</table>
### SPELLING INTERVENTION

<table>
<thead>
<tr>
<th>Awareness of syllables and sounds</th>
<th>Phoneme-grapheme allocation</th>
<th>Memory retrievals</th>
<th>Knowledge of rules and morphemes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercises to identify, categorize, segment, delete or discriminate syllables and sounds in words</td>
<td>Systematic instruction of phoneme-grapheme correspondences and exercises for phoneme analysis at the lexical and sublexical levels</td>
<td>Systematic exercises for storing/remembering grapheme</td>
<td>Acquiring orthographic and morphemic regularities</td>
</tr>
</tbody>
</table>
TREATMENT SETTINGS

- Support from their first school year, as an early start is more effective than a start from the second to sixth year.

- Support measures should be implemented in individual group settings or small groups settings (≤ five persons).

- Existing comorbidities and the severity of the disorder should be considered.
THERAPIST’S PROFESSION

- The therapist’s profession affects the effectiveness of the intervention.
- The interventions should be implemented by experts in reading and spelling development and its promotion.
DURATION OF TREATMENT

- A longer duration of the intervention is associated with a greater improvement in reading and/or spelling performance.
- Therefore support should last as long as it takes to reach an ability to read and spell that enables them to participate in public life in an age-appropriate way.
- In most cases this means several years of intense support and treatment.
COMORBIDITIES

- The role of comorbidities for the effectiveness of therapeutic methods has thus far been intensively investigated.
- Psychiatric comorbidities are
  - anxiety disorders (20%),
  - depressive symptoms (14%),
  - hyperkinetic disorder or attention deficit/hyperactivity disorder (ADHD) (9-20%)
  - absenteeism from school
  - conduct disorders.
- These comorbidities influence treatment effectiveness, compliance within treatment.
COMORBIDITIES

- The comorbid occurrence of reading and spelling disorder and specific disorder of arithmetical skills is significantly increased.
- The prevalence rate was between 20% and 40% in children who had already been diagnosed with reading and spelling disorder.
- The risk of a disorder of arithmetical skills is increased by four to five times.
COMORBIDITIES

- Significant accumulation of expressive and/or receptive language disorder in children and adolescents with reading and spelling disorder, but reliable prevalence rates cannot be derived.

- For the diagnosis of reading and/or spelling disorder,
  - the comorbidities should be diagnosed and
  - included in the treatment plan (need for a specific treatment setting).
KEY MESSAGES

- The diagnosis of reading and spelling disorder should be based on the discrepancy between the reading and/or spelling level and the age norms, grade norms, or intelligence (IQ). Reading and spelling disorder should be diagnosed only if the reading and/or spelling performance differs by at least one standard deviation from the age or grade norms.

- For the purposes of the diagnostic evaluation, it should be ascertained whether attention deficit syndrome (ADS), attention deficit/hyperactivity disorder (ADHD), anxiety disorder, or disorder of arithmetical skills is present.

- Interventions should target the symptoms of reading and spelling disorder and consider comorbid disorders.

- Children with difficulties in acquiring reading and spelling skills should receive supportive measures as early as in their first year.

- The support intervention should continue until the achieved reading and spelling ability enables a patient to participate in social and public life in an age-appropriate way.
NEED FOR RESEARCH

- Reliability and validity of any diagnostic approach should be evaluated and there is a need for evaluated and standardized need of diagnostic instruments in different languages.
- Substantial need exists for research in the form of randomized controlled trials, for all interventional approaches and method.
- Intervention studies (RCT) including comorbidities like anxiety, depression are still missing and should be conducted.
- There were no studies available investigating effectiveness in different treatment settings (in school, in clinic, private practice..)
USING THE S3 GUIDELINE IN CLINICAL PRACTICE

- The guideline should be used in all clinical, outpatient, and inpatient settings where children and adolescents with school-related problems and associated psychosomatic symptoms or psychological disorders are seen.

- The guideline also provides recommendations for the diagnostic evaluation and treatment in the children's eye care center, in ear, nose, and throat practices, and in the pediatric audiological examination for the diagnostic evaluation of children with hearing, reading, and spelling problems.

- The guidelines provide clear therapeutic recommendations whose implementation helps save costs and avoid serious psychosocial stress resulting from insufficient/unsatisfactory therapy.
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