Language Profiles and Naming in Children with Word Finding Difficulties

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Running head: Language profiles in children with WFDs

Word count: 2222

Number of tables: 5

Abstract

Objective

To examine whether lexical access problems in children with word finding problems,(WFDs) are restricted to measures of naming or include wider language impairments and the extent to which language skills are related to performance in the accuracy, latency and definitions of lexical items that are comprehended.

Patients and Methods

Thirty one children with identified WFDs completed a set of standardised language measures and an experimental naming and definition task.

Results

The current cohort had difficulties with a range of language skills. Measures of phonology and non-word repetition were significantly impaired and different to those of typically developing children. Phonological processes and measures of receptive and expressive language predicted accuracy in naming comprehended items but failed to predict the latency to name or the provision of accurate definitions.

Conclusion

Children with WFDs difficulties often have additional language difficulties; these difficulties are predictive of performance on confrontational naming tasks. Latency to name, although a significant impairment, was not related to the standardised measures. Further research is needed to identify measures associated with speed of lexical retrieval. The data highlight the importance of examining the precursors to lexical access difficulties and examining different indices of lexical performance when intervening with children word finding difficulties.

Key words: Lexical access, word finding difficulties, children

There is an increasing appreciation of the role of the lexicon in language development and the acquisition of literacy abilities [1]. Difficulties in accessing the lexicon are likely to compromise children's communication and their ability to acquire academic skills. Such problems raise challenges for clinical assessment [2] and for intervention [3,4,5]. Most if not all developmental language disorders are characterised by delayed vocabulary acquisition [6]. Therefore to identify the causal mechanisms in developmental naming disorders it is necessary to assess the related components of the language system for specific types of lexical difficulties. Research on the relationship between lexical parameters and difficulties in retrieving lexical items is relatively scarce [7]; limiting the developmental of comprehensive theoretical models. The current study addresses this issue by examining the relationships between diagnostic measures of language impairment and performance on experimental measures of lexical performance for a cohort of children identified with lexical access problems.

Children who have specific problems with lexical access are often described as having Word Finding Difficulties (WFDs) [8]. These children have a dissociation between the comprehension and production of words, which impacts on their expressive language and reading comprehension [9]. The difficulty has been explained by a range of factors including semantic, phonological and retrieval problems [7] but there has been a failure to consider children's performance across these key parameters. Currently, latency to respond is viewed as the most impaired naming process and the children's phonological skills have been described as an area of relative strength [9].

Despite the relatively frequent occurrence of WFDS in children, reported as 23% of clinical populations [10], the associated language deficits of children with WFDs are not well documented. Investigations of the language profiles of groups of children with naming difficulties indicate that the children may have additional language problems [11,12,13]. However, most of these investigations have focussed on general clinical populations of children with language problems and it is, thus, unsurprising that associated problems with language have been identified. There is a need for investigations which identify, a priori, a cohort of children with WFDs and examine co-occurring language problems in this cohort. The first issue to be addressed in this study is to provide a description of the language skills of children identified specifically on the basis of their WFDs.

Data from such a sample can inform our understanding of population parameters [14] and also provide the opportunity to map the relationships between lexical competence and other language covariates. Potential linguistic covariates of WFDs can be derived from other studies of language impaired populations, such as SLI. Assessments of phonological processing, semantic representations, nonword repetition and grammatical comprehension have all demonstrated high levels of specificity and sensitivity in differentiating children with SLI from their typically developing peers [15, 16, 17,18]. Consequently, an evaluation of the performance of children with WFDs on these measures allows an investigation of the extent to which children WFDs are vulnerable in areas deemed to be markers of

SLI.

An examination of performance on these language measures provides the opportunity to delineate the relationships between language skills and experimental measures of lexical competence in participants with WFDs. Lexical competence can be assessed by naming accuracy, speed of lexical retrieval and through the elicitation of definitions [7]. Together these tasks provide a comprehensive measure of a child's lexical system. Moreover, performance on these measures reliably differentiate the performance of children with WFDs from chronological age and language matched peers [19, 20, 21]. The second issue to be addressed is the ways in which these measures are underpinned by different language processes for children with WFDs.

The present study aims to evaluate the performance of children with WFDs on language and cognitive measures that are known to be compromised in other identified language impaired populations. Investigating the relationships between language covariates and experimental assessments of lexical competence can help understand the nature of these children's difficulties, thereby contributing to the development of clinical diagnosis and intervention.

Methods

Participants

Thirty-one children who experienced word-finding difficulties participated in the study, mean age 7;1 [range 6;4-7;10]. The lower age-band was determined by the standardisation of the TWF and the upper age band was used to minimise the variability in the sample in terms of educational opportunities and other developmental experiences. The children were identified following a wider survey of educational provision for children with word finding difficulties [10]. Schools were sampled where professionals had reported that they had children with primary word-finding difficulties. Children were drawn from 11 different language support services, nine of these were attached to mainstream schools. Once identified by the professional (teacher or speech and language therapist), children were required to meet the following the criteria for inclusion in the WFDs sample: (1) to fall within an eighteen-month age band (6;4.-7;10); (2) demonstrate word-finding difficulties relative to their comprehension skills as identified by the Test of Word Finding Difficulties [21]; (3) have age appropriate (at or above the 25th centile) non-verbal abilities as measured by Raven's matrices [23] and , (4) have no marked difficulties in articulation as measured by the Edinburgh Articulation Test [24]. Materials

Standard measures

Test of Word Finding; Word finding difficulties are identified on the basis of a prorated accuracy score where percent of known words named accurately are computed [22].

Naming: British Abilities Scales II (BAS II); Naming subtest [25]: Children are shown a series of familiar items and asked to name them

Receptive language: Test of Reception of Grammar [26]. A multiple-choice test designed to assess understanding of grammatical constructions. Children are shown four pictures and the assessor reads a sentence. The child is required to select a picture that matches the sentence:

Semantic representations: Description naming section of the TWFDs. Children are presented with attributes of a target and required to generate a response

Phonological Awareness: Phonological Assessment Battery [27]: rhyme and alliteration scales - For the rhyme test children choose two words that rhyme out of a choice of three (one irrelevant word and two that rhyme). The alliteration test is similar with the exception that the chosen words have the same beginning sound.

Fluency measures: Phonological Assessment Battery [27]: fluency tests which involves children generating as many words as they can in each of the following areas: (a) semantic, e.g., food and animals; (b) alliteration, e.g., words beginning with m and b; and (c) rhyme, e.g., words that sound like 'whip' and 'more'.

Working Memory: Children's Nonword Repetition [28] involves the child hearing a single novel word-like item, such as "barrazon", and being required to repeat it immediately

Experimental Tasks: The stimuli for the naming task consisted of 40 coloured drawings of objects and 20 coloured drawings of actions [19]. The definitions task comprised a subset of 12 items balanced for frequency and word class [20].

Procedure

Each child was tested individually. On the first session children completed the entry criteria tasks. This session was followed by a session in which the other standard measures were administered. Children's naming and comprehension of the test stimuli were assessed in a subsequent session. Items were randomly presented to each child for lexical production with the naming task being completed before the comprehension task. Stimuli for both naming and comprehension were presented on a portable computer that recorded accuracy and latency. In parallel, a tape recorder was used to capture oral responses for later error analysis and an ongoing written record was kept. Children were provided with five practice items for each condition. No feedback was provided on the test items.

Definitions were collected approximately two weeks later. For objects children were asked "Can you tell me what a/an X is?" and for actions children were asked "Can you tell me what xing is?". All children were provided with the prompt "Is there anything else you can tell me about x / xing?". The children's responses were recorded on a tape recorder and written notes were taken were taken to supplement data from the tapes. Definitions were later transcribed and analysed.

Results

5

All participants had word-finding problems as defined by clinicians and severe problems as reflected by the standardised measure (TWFDs: Mean standard score 71, SD=1.9). Scores on the TWFDs were significantly correlated with all other standardised measures (p<.005) except for the three fluency measures where no significant correlations were obtained. Other language skills showed a marked variation Table 1 presents the children's Z scores on the standardised measures collected for the analyses. Difficulties were evident with phonology, fluency and nonword repetition. A repeated measures ANOVA on these scores indicated that there was a significant effect of measure, F $(5.425, 30) = 25.684, p < .0005, \eta^{2=}.61$. Children's performance on Raven's matrices (nonverbal ability) was significantly better than performance on all the language measures (p < .0005 in all cases). Examination of the differences between the language measures, adjusted for multiple comparisons, revealed that the scores for nonword repetition, semantic fluency and alliteration fluency did not differ significantly, but these scores were significantly worse than those of the other measures (p < .0005 in all cases except for rhyme fluency p = .003). Scores on the measures of phonology (rhyme and alliteration), naming, semantic representations, description and receptive grammar did not differ significantly from each other, and although scores for receptive grammar were depressed the mean score was within the average range. Thus the children demonstrated impairments on markers of SLI, but their performance, while low, was not clinically impaired for receptive grammar or phonological awareness with all measures being within 1 SD from the mean. In all cases standard deviations indicated that, for this population, there was significant variation in performance. This variation in performance provides a basis for examining relationships between the standard measures and performance on assessments of naming.

INSERT TABLE 1 ABOUT HERE

We examined children's performance on experimental measures of naming. There were high levels of successful comprehension on these assessments (objects M= 94%; actions 94%). In the analyses of naming accuracy and naming latency any lexical items which children failed to identify in the comprehension was removed to ensure that analyses were based on naming difficulties. This resulted in different item sets for each child and therefore proportion scores were used in subsequent analyses. Latency scores were tabulated for correct responses only.

INSERT TABLE 2 ABOUT HERE

Table 2 presents the children's scores on naming accuracy, naming latency and definitions. Previous analyses have indicated that the children's accuracy and latency of naming were significantly worse than that of chronological age matched peers and the children provided fewer accurate definitions than chronological age matched peers [20,21,22]. The relationships between the experimental naming measures and the standardised tests were initially examined by a series of correlations with Bonferroni correction of .008. Table 3 presents the correlations across the experimental measures of naming and the standardized assessments. As predicted both the TWFDs and the BAS naming were associated with the experimental measures of naming; contrary to expectation there was a dissociation in the patterns

with BAS related to action naming and TWFDs related to object naming. The pattern of significant correlations with other language measures indicated that rhyme awareness measures were significantly associated with naming objects. In contrast naming actions was associated with grammatical abilities, and rhyme awareness at the corrected level of significance. Alliteration awareness was associated with the production of the accurate definitions for objects but no significant correlations, at the required significance level, were evident for action definitions. For latency to name there were no significant associations with any of the standardised measures.

INSERT TABLE 3 ABOUT HERE

To establish the relationships between language measures and the measures of naming a principal components analysis using a Varimax with Kaiser Normalization rotation method was computed to identify underlying language factors. The analysis met all the necessary statistical assumptions and only those factors with eigenvalues greater than 1.0 were considered. The analysis generated a three factor solution which accounted for 74% of the variance. The factor loadings are presented in Table 4. Given the small sample size only factor loadings of .7 and above were examined to explain the factor. Factor 1 accounted for 34% of the explained variance with significant loadings with nonword repetition and alliteration. This factor is interpreted as a phonological processing dimension. Factor 2 accounted for 21% of the explained variance with significant loading on semantic fluency. This factor is interpreted as a lexical fluency dimension. Factor 3 accounted for 20% of the explained variance with the significant loading being receptive grammar. This factor is interpreted as a receptive language dimension.

INSERT TABLE 4 ABOUT HERE

We considered the relationship between these three factors scores and the indices of naming performance on the experimental measures of lexical performance. Four multiple regressions were computed to test the role of the three exploratory factors identified in naming for object and action naming. Following Cain, Oakhill, & Bryant (2004) we use a minimum of 10 data points per predictor. In all cases residuals were normally distributed about the predicted variable. Using the enter model a significant model emerged for object naming, F(3,30) = 4.407, p = .01, $R^2_{adj} = .25$, and action naming, F(3,30) = 6.428, p = .002, $R^2_{adj} = .35$. As shown in Table 5 all the significant models for naming included phonological processing and receptive language.

INSERT TABLE 5 ABOUT HERE

We examined the relationship between latency to accurately name and the identified factors. As expected given the low correlations for individual measures no significant model emerged for either latency for object naming, F (3,30) = 1.334, p = .28, $R^2_{adj} = .03$, or latency for action naming, F(3,30) = 1.529, p = .23, $R^2_{adj} = -.05$.

Examination of children's performance with the definitions provided a mixed picture. A significant model was achieved for object definitions F(3,30) = 3.027, p = .04, $R^2_{adj} = .17$, with no single significant predictor. No significant model emerged for action definitions, F(3,30) = 1.377, p = .27, $R^2_{adj} = .04$.

Discussion

Lexical access remains a relatively under researched area of language development, yet a substantial minority of children experience difficulties with WFDs. This study aimed to consider the wider language skills of children with WFDs and the extent to which these measures could be associated with objective measures of naming performance. Children with WFDs produced a varied profile of performance on language measures indicating that naming problems often co-occurred with other deficits. Receptive grammar remained a relative strength in the population with means scores within the normal range whereas measures of fluency and non word repetition were areas of relative weakness. Nonverbal ability was not related to performance on any of the measures of lexical performance.

Performance on measures of naming accuracy were captured in the regression analyses by factors that reflected phonological processing and receptive language. These data indicate that lexical retrieval deficits are underpinned by both semantic and phonological processes. Importantly even when children had provided evidence of comprehending a lexical item their naming was influenced by their language comprehension skills. For both naming objects and actions receptive language scores accounted for a significant proportion of the variance, indeed more variance was accounted for than by the phonological processing factor. This suggests that underlying semantic representations influence accurate naming of known items. Despite being one of the most vulnerable dimensions of the children's language performance semantic fluency was not associated with any of the experimental measures of lexical performance, However we hypothesise that this would be an important factor in narrative or descriptive naming [3].

The current study has demonstrated that children with WFDs are vulnerable to deficits in other areas of language the language system. The pattern of performance does not mirror that of either children with SLI as their receptive language scores are within the average range, although there are similarities to 'poor comprehenders' [31]. Moreover, these language skills do not explain all dimensions of the children's naming performance. Importantly latency to respond, a key feature of WFDs, was not associated with any of the standardised measures used and could not be explained by the factors identified in the cluster analysis. Thus the slowness of the children to respond remains an unexplained phenomenon, a processing deficit that is unrelated to naming accuracy and to other measures of language. This raises two key questions; do the children's response times reflect a more generalised slowing of cognitive processes [29], and can standardised assessments identify lexical processing efficiency reliably. These areas need to be more systematically examined and new research techniques will be needed to help elaborate the developmental factors that underpin lexical access. Such studies should also address the issue of whether WFDs is a distinct disorder or a one reflection of a more generalised slower processing system that differentially affects aspects of language processing [30] as the current data set would suggest.

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Table 1. Children	's scores	on standardised	measures
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Test	Mean Z	Standard
	score	deviation
Ravens Matrices	.34	.69
Test of reception of grammar (TROG)	92	.68
PHAB Alliteration	-1.04	.77
PHAB Rhyme	-1.09	1.04
PHAB Rhyme Fluency	-1.41	.60
British Abilities Test Naming	-1.56	.57
PHAB Alliteration Fluency	-1.74	.59
PHAB Semantic Fluency	-2.10	.42
Nonword repetition	-2.13	.90

Table 2. Performance of children with WFDs on experimental measures

Experimental task for items when	WFDs results	Range
comprehension correct		
Target Objects- naming correct	0.77	0.5-1.0
Target Actions- naming correct	0.62	0.25-1.0
Mean Latency in seconds for objects	1.94	1.2-3.32
named correctly		
Mean Latency in seconds for actions	2.28	1.3-3.9
named correctly		
Correct definition objects	0.76	0.38-1.0
Correct definition actions	0.70	0-1.0

Measure	Naming	Naming	Naming	Naming Actions	Definitions	Definitions
	objects	Actions	objects	latency	objects	actions
	accuracy	accuracy	Latency		accurate	accurate
TWFDs	.73***	.30	25	34	.28	.04
Naming BAS	.45*	.69***	16	12	.18	.04
Test of reception of	.41*	.52**	.02	13	.35	04
grammar						
(TROG)						
Non word	.35	.40*	30	23	.25	.15
repetition						
PHAB Alliteration	.41*	.40*	21	27	.47**	38*
PHAB Rhyme	.52**	.49**	23	29	.39*	.30
PHAB Alliteration	.31	.22	24	31	.13	.17.
Fluency						
PHAB Rhyme	.31	.12	21	17	.39*	.36*
Fluency						
PHAB Semantic	.11	12	27	30	.28	.03
Fluency						

Table 3. Associations between measures of naming and naming tests

*p<.05 **p<.005 ***p<.0005

Z scores	Component		
	1	2	3
	(Phonological	(Lexical Fluency)	(Receptive
	processing)		language)
Test of reception of	.29	.01	.92
grammar			
Non word repetition	.87	04	25
Alliteration	.83	.25	.13
Semantic fluency	02	.92	.13
Alliteration fluency	.67	.24	.34
Rhyme	.58	.19	.62
Rhyme fluency	.42	67	04

Table 4. Principal components factor structure for language measures in children with WFDs

Table 5. Results of regression analyses for accurate object and action naming

Factor	Beta	Т	Sig
Object naming			
Receptive language	.401	2.545	.01
Phonological	.395	2.505	.02
processing			
Lexical Fluency	.108	.684	.50
Action naming			
Receptive language	.482	3.281	.003
Phonological	.394	2.683	.01
processing			
Lexical Fluency	169	-1.150	.26