

Naming impairment in patients with Multiple Sclerosis – an explorative study.

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English Summary

Background: Word-finding difficulties are present in everyday life. It occurs in healthy people, but can be damaged in patients with aphasia, but also possibly for patients with Multiple Sclerosis (MS). This study explores whether patients with MS suffer from word-finding difficulties, and if so, which (distorted) underlying processes may influence these difficulties.

Research aims: 1) to determine the possible presence of naming impairments in patients with MS on a naming task; 2) to evaluate and relate the self-reported severity of word-finding difficulties with performance on the naming task; 3) to classify the naming errors in terms of characteristic mistakes; and 4) to investigate the relationship between naming impairments, cognitive functioning, and physical decline.

Methods: The Dutch Naming Test (DNT), a Visual Analogue Scale (VAS), Montreal Cognitive Assessment (MOCA), and Expanded Disability Status Scale (EDSS) were administered in order to answer the first, second, and fourth objective. The third objective was answered by classifying the characteristic by errors.

Results: The ratio of the diagnosed naming impairment was 30/70, where 30% of the participants scored below the cut-off. The self-reported severity of the naming impairment did not correlate to the scores on the DNT. Semantic errors revealed to be the most common. Cognitive performance (MOCA), but not physical decline, partly explained the DNT scores by 49.6%.

Conclusion: The results of the current study show that 30% of the participants have a naming impairment. Difficulties are partly explained by non-linguistic cognitive decline however; semantic processing difficulties also appear to play a role. There is no relation between self-reported word-finding difficulties and naming difficulties.

Recommendations: Look closely at every patient with MS. They can experience word-finding difficulties but do not necessarily have a naming impairment and vice versa. A semantic approach would be recommended as treatment for word-finding difficulties.

Keywords: MS, Naming Impairment, Dutch Naming Test.

Dutch Summary

Achtergrond: Literatuur is niet eenduidig over de aan/afwezigheid van woordvindingsproblemen in patiënten met MS. Echter, patiënten geven toch aan vaak moeilijkheden te ervaren in het vinden van woorden. Voor therapeutische doeleinden is het belangrijk om te bepalen of patiënten met MS daadwerkelijk last hebben van woordvindingsproblemen en zo ja, om te onderzoeken welke verstoorde processen daar ten grondslag aan liggen.

Onderzoeksvragen: 1) vaststellen of er sprake is van woordvindingsproblemen bij mensen met MS; 2) bepalen in welke mate patiënten zelf kunnen aangeven in hoeverre zij die problemen ervaren; 3) classificeren van gemaakte fouten op een benoemtaak; en 4) constateren of cognitie en/of het ziekteverloop invloed hebben op de woordvindingsproblemen.

Methode: De DNT, een VAS, de MOCA en EDSS werden afgenomen om de eerste, tweede, en vierde onderzoeksvraag te beantwoorden. Het beantwoorden van de derde onderzoeksvraag werd gedaan door een classificatie te maken van gemaakte fouten op de DNT.

Resultaten: 30% van de participanten hadden woordvindingsproblemen. De correlatie tussen de DNT en de VAS was insignificant. Het grootste aantal fouten die gemaakt zijn, waren: semantisch (49%). De EDSS had geen invloed op de DNT. De MOCA verklaarde daarentegen 49.6% van de DNT.

Conclusie: Het resultaat van de huidige studie geeft aan dat de woordvindingsproblemen bij patiënten met MS deels kunnen worden verklaard door verminderde cognitie. Desondanks, lijken processen in het semantisch systeem ook aangedaan. Er is geen verband gevonden tussen zelf-gerapporteerde ernst van de woordvindingsproblemen en de score op de DNT.

Aanbevelingen: Patiënten met MS kunnen moeite hebben met het vinden van woorden, maar hoeven geen gediagnosticeerde woordvindingsproblemen te hebben en vice versa. Mocht de logopedist therapie geven, dan is een semantische benadering aan te raden.

Trefwoorden: Woordvindingsproblemen bij mensen met MS, Nederlandse Benoem Test.

Introduction

Multiple Sclerosis (MS) is a disabling neurological degenerative disease of unknown etiology, with an autoimmune component. Demyelination produces lesions throughout the white matter of the brain and spinal cord. Resulting in a range of neurological problems, such as motor and sensory deficits.¹ According to literature, about 40-65% of the patients with MS will, at some point of the disease course, develop cognitive deficits.² Cognitive deficits that have been reported mostly comprise: executive functions, working memory, attention, information processing speed, visual perceptual skills, and long-term memory.³ This cognitive decline, which appears to worsen over time, has a negative impact on patients' language functioning.⁴

Neuropathologically speaking, MS is characterized by lesions located subcortically.⁵ This makes research on language functioning in MS particularly difficult and contradictory, since cortical regions have traditionally been more associated with language functioning.⁶ The little research that is available on language functioning in patients with MS is inconsistent in its findings.⁵ Some studies have found the presence of language impairment,⁷⁻¹¹ whereas others did not.¹²⁻¹⁶ These inconclusive findings in the literature could be due to methodological issues affecting the ability to detect subtle language impairments.⁶ However, they can also be due to the difficulty disentangling language and cognition.¹⁷

Language is involved in both reciprocal and recursive information exchange with each element of cognitive functioning. The precise nature of the (in)dependence of, and interaction between language and cognition therefore remains an unsolved scientific problem.¹⁷ It has been suggested that, if present, language problems in MS are likely to be involved in disruptions of 'high-level language'. The term high-level language has been defined as the ability to use multiple areas of linguistic and cognitive processes at the same time.¹⁸ Tasks that rely on this interaction are: problem solving, planning, decision-making, linguistic flexibility, language production, and verbal fluency.¹⁹ Sepulcre et al. recently suggest that these high-level language-related problems have probably been underdiagnosed in MS, and specifically indicate the existence of lexical retrieval difficulties.²⁰ Lexical access has been described to change in patients with MS. For example, patients usually have a delay in speed of word retrieval compared to healthy adults.²¹

Confrontational picture naming taps into part of the lexical retrieval system, as it requires the complete process of retrieving lexical items from the long-term memory.²⁰⁻²¹ Naming impairments in MS have been reported by a number of researchers in the past but findings on their presence

and nature remain contradictory.^{3,5,6,20-23} Two studies compared naming errors in patients with MS with healthy controls.^{22,27} Both studies found that the MS group showed more naming errors than the healthy controls. Especially errors semantically related to the target word. The findings of the studies imply that there is a difference in errors made by MS patients in comparison to healthy controls, suggesting a presence of a semantically based deficit. When comparing patients with MS to patients with aphasia, the difference in naming errors can be caused by difference in damage of subcortical language areas.²⁷ These studies suggest that it could be very informative not only to investigate performance in terms of accuracy, but also to classify the naming errors when investigating word-finding in MS.^{22,27} Analyzing the naming errors can therefore add value to the clinical implications and can provide more information about the origin of the naming impairment.

Known from clinical practice and MS forums is that patients with MS often report experiencing word-finding difficulties.²⁴ Investigating the relationship between the experienced word-finding difficulties and the diagnosed naming impairment can provide more insight into the nature of naming impairments in patients MS.²⁵ It is known from literature that as the disease progresses, insight in functioning and the illness in general decreases. This implies it might be difficult for patients with MS to assess their capabilities in naming and finding words.^{2,26} It can be of value, for clinical implications, to make a distinction between the experienced word-finding difficulties and the diagnosed naming impairment.

In summary, word-finding difficulties are an often-heard difficulty of patients with MS. Literature suggests that lexical access, assessed by naming tasks, are part of so-called high-level language tasks that involve a complicated interaction between cognitive and linguistic processes. It has been suggested that these difficulties are probably underdiagnosed in patients with MS. Determining whether patients with MS indeed suffer from naming impairment, and if so, which (distorted) processes may influence these difficulties, is important to improve clinical care. Furthermore, it is critical to investigate the relationship between the experienced word-finding difficulties and the clinically diagnosed impairment. More research on a relatively large population of MS patients will provide important data to support the debate on possible (non) existence of naming impairments in MS perceived word-finding difficulties, and their relationship to possible cognitive and physical decline.

Aim of the study

The first objective of this study was to determine the possible presence of naming impairments in Dutch patients with MS on a confrontational naming task. The second objective was to evaluate their self-reported severity of word-finding difficulties and to relate this to their performance on the naming task. The third objective was to classify the naming errors in terms of semantic, phonological, or other relation to the target. Finally, the fourth objective was to investigate the possible relationship between the naming impairment, cognitive functioning, and physical decline in patients with MS.

Method

Study design

This study has a cross-sectional, single-center, explorative, quantitative design.

Population & domain

Participants were recruited for data collection by the researcher in the participating healthcare institution between February and May 2019. This institution is specialized in the care of patients with MS. To be eligible to participate in this study the patient had to be diagnosed with MS, admitted in the care institution, over the age of 18 years, and speak native level of Dutch. Excluded from the study were subjects with severe visual impairments, patients with acquired brain injuries, severe dysarthria, or any other speech related impairment. The participants were selected in consultation with a senior speech and language therapist (SLT) from different wards in the care institution.

Measurements

The *Dutch Naming Test (DNT)* was used in order to answer the first objective of this research, determining the presence of naming impairments. The DNT is a confrontational naming task that is validated for people with aphasia.²⁸ The DNT consists of 92 images, which are presented on paper. The scores of the answer can range from: 0 “wrongly named”; 1 “somewhat related to the target word”; 2 “related to the target word”; 3 “correctly named”, with a total score of 276. If participants score below the cut-off score, which is 246, they can be diagnosed with having a naming impairment.

A *Visual Analogue Scale (VAS)* was used to help participants rate their perceived severity of word-finding difficulties.²⁹ The scale ranged from 1 to 10. Where 1 represents “no problem in finding words” and 10 represents “severe difficulties in finding words”.

Transcriptions of errors made on the DNT were divided based on the *classification of naming errors* proposed by Bastiaanse³⁰: phonetic, phonological, or semantic errors. An additional category for errors caused by visual impairment has been added (as visual impairments are common in MS).³¹

The *Montreal Cognitive Assessment (MOCA)* is a validated cognitive screening instrument, used in clinical practice to screen for cognitive deficits.³² The MOCA has 8 sub-tests that examine different cognitive functions: attention and concentration, executive functions, memory, language, visual-constructive skills, conceptual thinking, arithmetic, and orientation. The total score of the MOCA is 30. If a patient scores below 25 there is an indication for cognitive deficits. The scores are differently distributed per sub-tests. The scores on the written/drawn tasks were corrected for patients with loss of the ability to write due to arm-hand dysfunction. In this study the MOCA was used to capture cognitive functioning of the patients with MS.

The *Expanded Disability Status Scale (EDSS)* is a validated measurement instrument in quantifying disability in MS and monitors changes in the level of disability over time.³³ This instrument consists of 10 questions regarding the physical decline in patients with MS. Each question represents a level of disability, referenced to a EDSS-score. The EDSS-scores range from 0 “no physical constraint” to 10 “death”. This scale is used to show the relationship between physical decline in the trajectory of the disease and the possible naming impairment.

3.4 Procedure

Participants were approached by the researcher after consultation with the SLT. The purpose and procedure of the study were verbally explained to the participants individually. After this explanation they received an information letter and an Informed Consent (IC). The participants had 10 days to consider participating in the study and sign the IC.

After signing the IC, an individual appointment was made to administer the tests. All sessions were recorded using an Olympus 853 voice recorder. First, participants were asked to rate their perceived word-finding difficulty, using the VAS. The DNT was administered directly after that. Next, the MOCA and EDSS were administered.

All the measurements were conducted in one session. If the patient experienced fatigue or was hindered in another way, the session was postponed or divided into multiple sessions until all data were collected.

The DNT, MOCA, and EDSS were administered and scored according to the manuals.^{18,22-23}

3.5 Ethical Issues

The research proposal was examined by an internal review board in the HU University of Applied Sciences in Utrecht and was deemed exempt from The Medical Research Involving Human Subjects Act (Wet Medisch Wetenschappelijk Onderzoek Met Mensen). This study was conducted according to the principles of Helsinki and in accordance with the General Protection Regulation (Algemene Verordening Gegevensbescherming - AVG)³⁴. Every participant was provided with a patient information letter and gave written consent before participation. All data were anonymously processed.

3.6 Data Analysis

The inferential and descriptive statistics were executed in IBM SPSS Statistics 25.³⁵ All data were visually inspected for assumptions of normality and linearity. Descriptive statistics were obtained (Mean score (M) and Standard Deviation (SD)) for the results on the DNT, the self-reported VAS, MOCA scores (overall and subtests), and EDSS-scores.

To answer the first objective of this study, DNT-scores were compared to the cut-off to identify the number of patients with confrontational naming impairments.

For the second objective, the VAS-scores were analyzed after which the relationship between raw scores on the DNT and the VAS, was explored by performing a Pearson's correlation analysis and backward stepwise multiple regression.

Any errors participants made in naming the pictures, were transcribed and categorized by error into the four categories to answer the third objective.

For the fourth objective, the raw DNT scores were correlated to the MOCA-, and EDSS scores. A backward stepwise multiple regression was executed. By analyzing the relations, it was determined how much of the score of the DNT can be explained by the MOCA, and EDSS.

Next, the results were specified by an additional backward stepwise multiple regression with individual results of the MOCA to determine the most influential subtests.

Results

Participants

A total of 40 patients with MS participated in this study. The age of the participants ranged from 36 to 71 years (M=57; SD=8.8). Table 1 shows the demographics of the age distribution divided by gender, cognitive functioning (MOCA), and the physical trajectory of the disease (EDSS).

Table 1

4.2 Descriptive statistics

Table 2 shows the descriptive statistics (mean, SD, and range) of confrontational naming (the DNT-scores), self-reported word-finding difficulties (VAS), cognitive functioning (MOCA), and physical trajectory of the disease (EDSS).

Table 2

For the first objective, the DNT-scores of the patients with MS were compared to the cut-off score of 246 points. Performance of 12 of the 40 participants was below the cut-off, indicating that 30% was diagnosed with a confrontational naming impairment.

In order to answer the first part of the second objective, the VAS-scores were analyzed. Two participants indicate experiencing word-finding difficulties with a 5 or higher. Other participants indicated to experience none, or minor word-finding difficulties (below the 5).

With regards to the third objective, the classifications of the different naming errors are shown in figure 1. The figure shows the distribution of the naming errors participants made during the assessment of the DNT. The most common mistake participants made were semantical errors (49%). For example: participants interchanged soldier for “knight/crusader”. After the semantical errors, the visual errors were most common (22%). Mistakes that were classified as visual errors were: soldier became “space-suit/play-mobil figure”. The phonological errors (14%) included mistakes, such as: soldier became “lodier”. There were no phonetic errors. The remainder of errors included no responses or “I do not know” (15%).

Figure 1

4.3 Inferential statistics

All data were visually inspected in SPSS, and approved for assumptions of normality and linearity.

To answer the second part of the second objective, the correlation between the VAS-scores and the total scores of the DNT was computed. Figure 2 shows the distribution with a red line, which represents the cut-off score of the DNT. The result of the Pearson correlation coefficient shows a lack of correlation between the VAS and the score of the DNT ($r^2=0.068$, $p=0.67$).

Figure 2

Regarding the answer to the fourth objective, a backward stepwise multiple regression was performed. The possible relationship between the EDSS-, and DNT scores, the MOCA-, and DNT scores, and the correlation between all three test scores, were examined. This was done until the remaining variables had a significance level below 0.1. The final model consisted of only the MOCA as a significant predictor of the total score on the DNT. The MOCA explained 49.6% of the DNT scores ($p<0.000$). EDSS was removed from the model due to lack of a significant relationship between the DNT and MOCA ($p=0.601$).

Influence of subtests MOCA on DNT

To understand which subtest(s) of the MOCA had the most influence on the scores of the DNT, a second backward stepwise multiple regression was performed. Until the remaining variables had a significance level below 0.1. The final model consisted of the predictors “conceptual thinking”, “orientation”, and “attention”, which combined explain 52.9% of the DNT scores. These subtests were significantly correlated with the DNT scores (attention: $r=0.613$; orientation: $r=0.677$; conceptual thinking: $r=0.541$).

Discussion

The primary objective of this study was to determine the presence of naming impairment in patients with MS, by administering the DNT. 30% of the participants scored below the cut-off score of the DNT, indicating a naming impairment. However, 70% of the participants did not have a naming impairment. These results are in line with the findings of previous studies that showed that there can, but does not have to be, a naming impairment in patients with MS. ^{3,5,6,20-23}

The self-reported severity scale for word-finding difficulties was correlated with the scores of the DNT, in order to answer the second objective. As hypothesized, the correlation between the self-reported severity and the scores of the DNT was not significant, meaning that participants were not able to rate their own performance.^{2,26} For example, there are participants who score a self-reported VAS of 2 (experiencing hardly any problems in word-finding) who perform far below the cut-off score on the DNT, and participants with a similar VAS score who score well above the cut-off. These data indicate that patients with MS seem to have little insight into their own naming impairment. The discrepancy between self-reported severity and functioning on language related tasks, has previously been reported as due to an overall poor insight in disease in patients with MS.²⁶ Their difficulty assessing their level of functioning properly, results in an over-/underestimation of their ability.²

For the third objective the characteristics of the naming impairment were classified by errors made by the participants. Most errors that were made were semantically related to the target. Participants made frequent semantic mistakes or gave a description of the word they were asked to name. These findings are in line with two studies who compared patients with MS with healthy controls and/or with patients with aphasia.^{22,27} Those study suggests that patients with MS appear to have a pattern of errors more similar to the healthy population in comparison with patients with aphasia.²⁷ They suggest that naming errors in MS might be due to a semantically based deficit. More specifically, impaired access to semantic memory.²² However, in this study phonological mistakes were present. At least some of the underlying disturbance in word-finding therefore appears a combination of problems in retrieving semantic information and to a lesser degree phonological information.²⁷

The fourth objective of this study was to investigate the relationship between cognitive functioning, physical decline of the disease, and the DNT scores. The EDSS score was removed from the regression model. This indicates that physical decline in the trajectory of the disease does not correlate to, or influence the scores of the DNT. The MOCA however, explains 49,6% of the DNT scores. The subtests of the MOCA responsible for this relationship, are: “attention”, “orientation”, and “conceptual thinking”, which are, remarkably, not language related subtests. The lack of influence from the language related subtests of the MOCA is very peculiar. In relation to the difference in findings described in the introduction, these results seem to indicate that the underlying cause of naming impairment in MS, at least in part is cognitive in nature.¹⁷⁻¹⁹ They have to some extent, a different origin than the word-finding problems typical for e.g. people with aphasia.²⁷ Word-finding requires, in addition to retrieval of linguistic information, at least some

attentional and informational processes.²⁰ It might be these processes that lead to word-finding difficulties in MS. When combining the results, it appears that word-finding difficulties in MS are due to a combination of more general cognitive processing difficulties, combined with a decline in semantic memory and lexical access.¹⁷⁻²¹

Looking at the results of the current study, a suggestion for clinical practice is to look closely at every individual with MS. Patients with MS can experience word-finding difficulties, but do not necessarily have a naming impairment and vice versa. The effect of the word-finding difficulties on daily life should be closely looked at. When a patient wants to be treated for word-finding difficulties, a semantic approach would be recommended, given the probable semantic nature of the deficit. The results of the current study fuels the current inconsistency in literature with more questions, such as: How come only 30% have a diagnosed naming impairment? Is confrontational naming a good method for analyzing lexical retrieval difficulties in MS? Plus, was the DNT sensitive enough to diagnose naming impairments in patients with MS? These questions indicate the necessity for further research.

A limitation of the current study is the lack of generalizability. Even though a large group of patients with MS were included, consisting of different ages, and gender, all participants were in advanced stages of their disease. This makes it impossible to say something about the entire MS population. Another limitation is that this study used a confrontational naming task that was not yet validated for patients with MS, which might result in over-/underdiagnoses of the naming impairment. Furthermore, despite the fact that severe visual impairment was an exclusion criterion for participation in this study, there were several participants for whom the visual impairment may have influenced performance on the picture naming task. Future research would benefit by including some form of visual assessment prior to recruitment.

Conclusion

The results of the current study show that 30% of the participants with MS living in the participating care institution have a naming impairment. The self-reporting severity of the naming impairment did not correlate to the scores on the DNT. Analyses of the types of errors the participants made, indicate that semantic processing might be underlying some of the word-finding problems. Regression analyses show that, cognitive performance partly explained the DNT scores. It remains unclear what other cognitive and/or linguistic functions might be involved in MS patients' difficulties naming pictures. It also raises the question why 70% of them do not have a naming impairment. Further research is required to answer the questions which cognitive functions are vital for patients with MS in confrontational naming, and which processes are responsible for the word-finding difficulty.

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Appendix 1: Tables and figures

Table 1: Demographic information of the participants with MS, including cognitive functioning (MOCA) and the physical decline (EDSS).

Participants	N	AGE			MOCA			EDSS		
		Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Female	19	56.9	7.5	36-70	20.6	6.0	7.5-28.8	8.1	0.5	6.5-8.5
Male	21	57.4	9.9	36-71	18.8	5.8	9-28	7.7	1.3	3-8.5

Table 2: Descriptive Statistics of the DNT scores, self-reported word-finding difficulties on the VAS, MOCA scores, and EDSS scores.

	Mean	SD	Range
DNT	251.9	25.1	168-276
VAS	2.2	1.2	1-6
MOCA	19.6	5.9	7.5-28.8
EDSS	7.9	1.0	3-8.5

Figure 1: Graphic representation of the classification of naming errors made in the DNT.

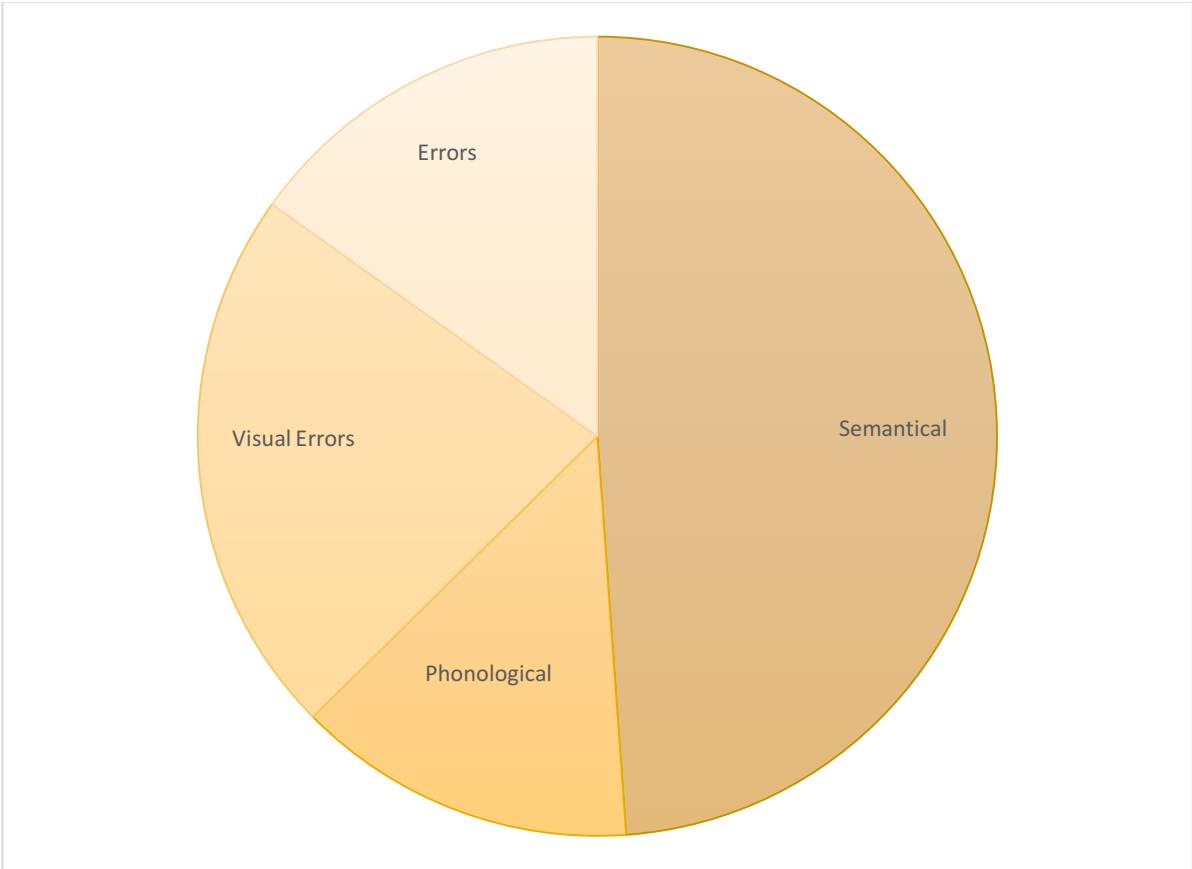
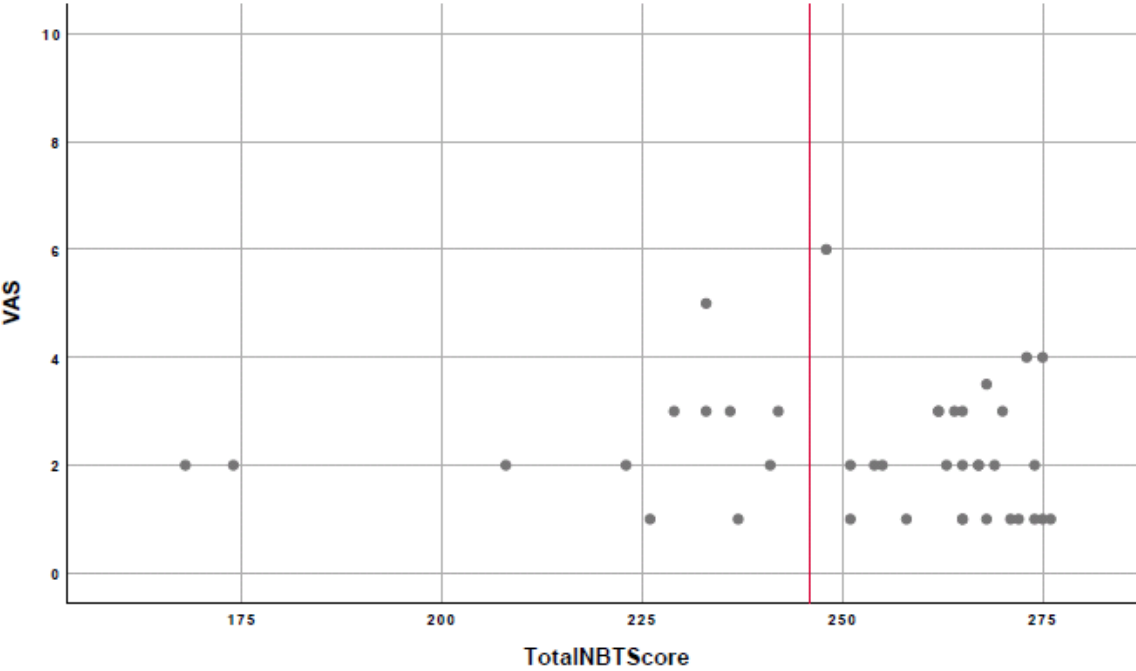


Figure 2: Graphic representation of the total DNT scores and the VAS-scale.



The x-axis represents the scores of the DNT, the y-axis represents the self-reported severity. The red line symbolizes the cut-off score of the DNT.