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CRITERION VALIDITY OF THE SELF-REPORT DYSPHAGIA ASSESSMENT TOOL EAT-10 AMONG NEUROLOGICAL PATIENTS

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Abstract

Aim: The aim was to study criterion validity of the Czech version of the Eating Assessment Tool (EAT-10) by comparing it with the Nursing Dysphagia Screening Tool (NDST). Moreover, the aim was to compare three items of the EAT-10 that focused on swallowing liquids (EAT3) and solids (EAT4) and on cough while eating (EAT9) with one item of the NDST, the swallow test (NDST8). *Design:* The design was cross-sectional. *Methods:* The sample included 57 hospitalized patients with a neurological condition. Their swallowing function was assessed using the EAT-10 and NDST. The relationship between the dichotomized EAT-10 and NDST and the selected items of both tools was expressed using the association coefficient phi (φ). *Results:* For all the studied EAT-10 cut-off scores, the relationship between the EAT-10 and NDST was negative; it was the strongest for a cut-off score of 15 (phi = -0.795; p <0.001). In all but one case, the relationship between the three items of the EAT-10 and the NDST8 was negative; it was the strongest for EAT3 (cut-off score of 3; phi = -0.701; p < 0.001). *Conclusion:* The results do not provide evidence for criterion validity of the EAT-10 using the NDST. Further research is recommended.

Key words: criterion validity, dysphagia, EAT-10, screening, swallowing.

Introduction

In recent years, the issue of nursing involvement in dysphagia (impaired swallowing) assessment has received considerable attention in the Czech professional literature. Specifically, dysphagia screening by nurses in patients with selected diagnoses has been promoted, and foreign-developed screening tools have been introduced (Tedla et al., 2009, p. 222), albeit without having been translated into Czech and validated by a well-established method. Not long ago, however, the results of a 5-year rigorous research study conducted in the Czech Republic (CR) led to the development of a simple nursing dysphagia screening tool (NDST) for use in patients with a neurological condition (Mandysová, 2014). The eight-item NDST was developed based on a comparison with an objective test (a so called "gold standard"), flexible endoscopic examination of swallowing (FEES); its diagnostic parameters are very good (sensitivity 95.5% and negative predictive value 88.9% for a cut-off score of 1) (Mandysová, 2014, p. 41). The tool was published in Czech as well, together with preliminary results of the research study (Mandysová et al., 2012, p. 48).

In contrast, swallowing problems can be assessed using self-report methods. Several Czech nurse-led studies have focused on the prevalence of subjectively perceived swallowing difficulties in seniors by means of the Czech version of the Eating Assessment Tool (EAT-10), which is a tool suitable for persons with a wide array of swallowing disorders (Belafsky et al., 2008, p. 924; Vejrostová et al., 2012, p. 32). Some of the studies have included an analysis of the relationships between individual items of the EAT-10 (Škvrňáková et al., 2013; Mandysová et al., 2014). The most comprehensive analysis by Mandysová et al. (2014) questioned the appropriateness of some of the items of the tool and recommended further research in this area. Specifically, it was pointed out that the EAT-10 contains few items dealing with emotions; in addition, some of the items appeared to be too similar and therefore redundant (Mandysová et al.,

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2014, p. 76). So far, however, the Czech version of the EAT-10 has not been used in conjunction with another dysphagia assessment method to study the validity of the tool. In fact, the issues of validity and reliability of the Czech version of the EAT-10 have not yet been dealt with in the literature.

In contrast, the validity of the EAT-10 has been studied in other countries. The Spanish version, the EAT-10 ES, was obtained using the back-translation process that was supplemented by a questionnaire regarding patients' and researchers' comprehension of the translated items (Burgos et al., 2012, p. 2051). Subsequently, 65 patients (average age 75) in three clinical situations – a) diagnosed with dysphagia, b) at risk of dysphagia, and c) not at risk of dysphagia – completed the EAT-10 ES, and the results were compared (Burgos et al., 2012, p. 2051). It was found that patients with a previous diagnosis of dysphagia showed significantly higher scores on the EAT-10 ES than the other two patient groups (Burgos et al., 2012, p. 2051). The Italian version, the I-EAT-10, was obtained using a 5-step cross-cultural adaptation process of translation and back-translation (Schindler et al., 2013, p. 717). Criterion validity of the tool was studied by correlating the EAT-10 and FEES scores in 94 patients (median age 67.7) (Schindler et al., 2013, p. 720). However, the results were not convincing (Schindler et al., 2013, p. 720).

Sokoloff (2013) discussed her experience with the EAT-10 in two geriatric rehabilitation units in Canada (a total of 123 patients; average age 82). The EAT-10 was used as a screening tool, and the results were compared with a previous diagnosis of dysphagia, obtained from the patients' documentation record. Using the cut-off score recommended by Belafsky et al. (2008, p. 923), i.e. normal < 3 points; abnormal ≥ 3 points, the EAT-10 result was "truly negative" in 52 patients, "falsely negative" in 16 patients, "truly positive" in 23 patients, and "falsely positive" in 32 patients. Next, the falsely positive patients were observed by a speech language pathologist during meals, who confirmed the absence of dysphagia. Consequently, Sokoloff (2013) questioned the appropriateness of Belafsky et al.'s (2008) cut-off score for very old people considering that some items might be evaluated as problematic when in fact the status could be related to normal aging changes and not pathological dysphagia per se.

To summarize, the issue of validity of the EAT-10 has been examined in several countries. As for the Czech version of the EAT-10, however, this issue has received only marginal attention. The recent development of a reasonably objective and easily administered Czech-language dysphagia screening tool with high diagnostic parameters enables to study selected aspects of validity of the EAT-10 with relative ease.

Aim

The aim was to study criterion validity of the Czech version of the EAT-10 (Vejrostová et al., 2012, p. 33) by comparing the results obtained with this tool with the results of the Czech version of the NDST (Mandysová et al., 2012, p. 48; Mandysová, 2014, p. 41). Criterion validity can be defined as "the degree to which the scores of an…instrument are an adequate reflection of a *gold standard*" (Mokkink et al., 2010, p. 743). For the purposes of this study, the NDST was considered the "gold standard" as the Czech literature does not contain other nursing instruments for assessing swallowing that would be the result of a rigorous research study or an unequivocally high-quality translation process.

Part of the aim was to compare three particular EAT-10 items: "swallowing liquids takes extra effort" (item 3, designated EAT3), "swallowing solids takes extra effort" (item 4, designated EAT4) and "I cough when I eat" (item 9, designated EAT9) and one particular NDST item: "thickened liquid: cough" (item 8, designated NDST8) as they focus either on the same activity (swallowing liquids or food) or the same problem associated with swallowing (cough). To conduct a comprehensive analysis of the relationships between the two tools, several EAT-10 cut-off scores were used. In contrast, because the NDST was considered a "gold standard"; its recommended cut-off score was adhered to throughout the study.

Methods

Design

This was a cross-sectional study that aimed to enrol patients with a neurological condition. Data were collected by physical assessment of the patients (using the NDST) and observation of their performance during the assessment. Moreover, the same patients completed the self-report EAT-10 tool. Preserved cognitive function (i.e. an ability to provide meaningful answers to questions) was important; therefore, the first step of the study involved administering a one-minute cognitive screening test. Patients who "failed" the cognitive screening test were excluded from the study.

Sample

Purposive sampling was used. A total of 68 hospitalized patients were approached, of whom 2 refused to participate and 9 did not pass the cognitive

screening test. In addition to preserved cognitive function (success on the cognitive function test), the following inclusion criteria were used: a) possibility of dysphagia based on the patient's primary neurological diagnosis, the patient is b) clinically stable, c) conscious, d) willing to collaborate and sign an informed consent, and e) is able to maintain upright sitting position with the chin at 90 degrees to the chest. The actual study involved 57 patients (age 73.7 ± 11.3, age range 45–91), 58% women. The patients' diagnoses were: cerebrovascular accident (47 cases), Parkinson's disease (4 cases), transient ischaemic attack (3 cases), and Alzheimer's disease (3 cases).

Data collection

Data were collected in the neurology clinic (department) of one regional and one district hospital between November 2012 and February 2013. The cognitive screening test was conducted using the one-minute verbal fluency test in the category "animals" (Kopeček, Štěpánková, 2008). The test is administered by asking patients to recite animals as fast as they can; their cognitive function is considered normal if they recite more than 12 animals in one minute (Kopeček, Štěpánková, 2008, p. 368). The patients were explained that a digital voice recorder would be used to record their performance; the recording was deleted immediately after the number of animals was counted and marked down by the researcher. The time was measured with a watch.

The NDST consists of 8 items (Table 1) (Mandysová, 2014, p. 41). The first seven items focus on the physical assessment of the reflexes and motor function of the muscles involved in swallowing. The eighth item consists of swallowing a thickened liquid (pudding consistency; four teaspoons) and observing the patient's response – an abnormal result is cough during the swallow test itself or during the first minute after the completion of the test (Mandysova et al., 2011, p. 391). For each item, the result could be normal (0 points) or abnormal (1 point). The overall result is considered abnormal if at least one item is abnormal (in other words, the cut-off score = 1) (Mandysová, 2014, p. 41).

The EAT-10 is a 10-item self-report tool describing subjective swallowing difficulty (Vejrostová et al., 2012, p. 33; Belafsky et al. 2008, p. 922) (Table 2). For each item, the degree of subjectively perceived difficulty is expressed using a Likert scale from 0 (no problem) to 4 points (severe problem). The maximum possible score is, therefore, 40 points.

All data were collected by one member of the research team, a master-level nursing student, who conducted physical assessment of the patients using the NDST and recorded the patients' verbal responses to the ten items of the EAT-10.

Table 1 Nursing dysphagia screening tool (Mandysová, 2014, p. 41)

Items	Yes	No
1. Ability to cough		
2. Ability to clench the teeth		
3. Symmetry / strength of the tongue		
4. Symmetry / strength of facial muscles		
5. Shoulder symmetry / strength		
6. Dysarthria		
7. Aphasia		
8. Thickened liquid: cough		

"Yes" is abnormal for items 6–8; "No" is abnormal for items 1–5.

Table 2 The EAT-10 items (Belafsky et al., 2008, p. 922)

Item
1. My swallowing problem has caused me to lose weight.
2. My swallowing problem interferes with my ability to go out for meals.
3. Swallowing liquids takes extra effort.
4. Swallowing solids takes extra effort.
5. Swallowing pills takes extra effort.
6. Swallowing is painful.
7. The pleasure of eating is affected by my swallowing.
8. When I swallow, food sticks in my throat.
9. I cough when I eat.
10. Swallowing is stressful.

Prior to data collection, the student underwent training concerning correct administration of the NDST by the first member of the research team who had developed the tool. The training consisted of watching a 15-minute video on correct use of the NDST and hands-on practice under supervision. To test logistics of the study, a pilot study was conducted, for which three patients in one of the mentioned hospitals were enrolled. The data were not incorporated in the main study.

Data analysis

The overall NDST result was dichotomized using the recommended cut-off score of 1. EAT-10 dichotomization was conducted using cut-off scores of 3–20 (e.g., for a cut-off score of 3, all total scores ≥ 3 were deemed abnormal, etc.). In order to compare the selected EAT-10 items with the swallow test of the NDST, the results were dichotomized as well. Specifically, for items EAT3, EAT4, and EAT9, the obtained scores were dichotomized using all the possible 4 cut-off scores, since in each case, the associated Likert scale ranged from 0–4 points, as

mentioned above. Scores reaching or exceeding the cut-off score were deemed abnormal. As for the NDST8, each result was either normal or abnormal; therefore, further modification of the results was not required.

Because the results obtained by both tools were dichotomized (normal versus abnormal), the patterns of association could be examined using 2×2 contingency tables and the association coefficient phi (φ) (Kraska-Miller, 2014, p. 69). The phi coefficient indicates the direction of the association (positive or negative) between two variables and ranges from -1 to +1 (Kraska-Miller, 2014, p. 69). Zero indicates no association between the two variables. A value of ±1 indicates a perfect association if the frequency of both variables in a 2×2 contingency table is evenly split (Kraska-Miller, 2014, p. 69). A negative association results when most of the data points are in the off-diagonal cells (upper right to lower left); a positive association results when most data points are in the diagonal cells (upper left to lower right) (Kraska-Miller, 2014, p. 69). Values < |0.30| indicate a very weak to negligible association, values ranging from |0.30| to |0.70| indicate a weak to fairly strong association, and values ranging > |0.70| indicate a strong association (Kraska-Miller, 2014, p. 70).

The null hypotheses H_o were: a) there is no relationship between the NDST and EAT-10; b) there is no relationship between the NDST8 and EAT3; c) there is no relationship between the NDST8 and EAT4; and d) there is no relationship between the NDST8 and EAT9. The corresponding alternative hypotheses H_a were: a) there is a relationship between the NDST and EAT-10; b) there is a relationship between the NDST8 and EAT3; c) there is a relationship between the NDST8 and EAT4; and d) there is a relationship between the NDST8 and EAT9. Statistical tests were performed with SPSS 21.0 statistical software (IBM SPSS, Inc., Chicago, Illinois); the significance level $\alpha = 0.05$.

Results

Forty-nine (86%) patients had an abnormal screening result using the NDST (Table 3). The frequency of abnormal EAT-10 results depended on the cut-off score – the lower the cut-off score, the higher the number of abnormal results. Specifically, the frequency of abnormal results was 37 (64.9% of the patients) for a cut-off score of 3. At the other end of the spectrum, the frequency of abnormal EAT-10 results was 4 (7%) for a cut-off score of 20 (in these four cases, the obtained scores were 21, 21, 22, and 23). At the same time, all of these four patients had a normal NDST result. In fact, for a cut-off score of 12 or more, the majority of patients with an abnormal EAT-10 result had a normal NDST result (Table 3). Likewise, 10 patients had an abnormal NDST result in all eight items, yet their EAT-10 result was 0 points (9 patients) and 2 points (1 patient), i.e. it was virtually normal.

The association coefficient phi showed a strong negative relationship between the EAT-10 and NDST for the following EAT-10 cut-off scores: 15 (phi = -0.795; $p < 0.001$), 12 (phi = -0.782; $p < 0.001$) and 13 and 14 (phi = -0.743; $p < 0.001$) (Table 3). For a cut-off score of 3, the relationship between the EAT-10 and NDST was weakly negative (phi = -0.297; $p = 0.025$). For all cut-off scores, the relationship was statistically significant ($p < 0.05$) (Table 3).

Table 4 shows cross-tabulation of NDST8 by EAT3, EAT4, and EAT9 for all the possible Likert-scale cut-off scores. For a relationship between NDST8 and EAT3, the association coefficient phi ranged from -0.399 ($p = 0.003$) (for a cut-off score of 4) to -0.701 ($p < 0.001$) (for a cut-off score of 3). The relationship was statistically significant for all 4 cut-off scores (Table 4).

For a relationship between NDST8 and EAT4, the association coefficient phi ranged from -0.231 ($p = 0.082$) (for a cut-off score of 4) to -0.587 ($p < 0.001$) (for a cut-off score of 2). The relationship was statistically significant for cut-off scores of 1–3 ($p < 0.05$) (Table 4).

For a relationship between NDST8 and EAT9, the association coefficient phi ranged from 0.076 ($p = 0.565$) (for a cut-off score of 4) to -0.552 ($p < 0.001$) (for a cut-off score of 2). The relationship was statistically significant for cut-off scores of 1–2 ($p < 0.05$) (Table 4).

Discussion

The study focused on criterion validity of the EAT-10. One of the most important findings was that for all the studied cut-off scores, the relationship between the dichotomized NDST and EAT-10 results was negative; it was statistically significant. The negative phi coefficient was due to the fact that most of the data fell in the off-diagonal cells (upper right to lower left) (Table 3). In other words, most patients with an abnormal NDST result had a normal EAT-10 result and most patients with a normal NDST result had an abnormal EAT-10 result. The negative relationship was the strongest for a cut-off score of 15 (phi = -0.795; $p < 0.001$) (Table 3).

Similarly, Schindler et al. (2013, p. 720) reported negative or only mildly positive correlations between

Table 3 EAT-10 and NDST cross-tabulation and the degree of association between the EAT-10 and NDST

EAT-10		NDST			Phi	
Cut-off score		**Normal**	**Abnormal**	**Total**	**Value**	**p**
3	Normal	0	20	20	-0.297	0.025*
	Abnormal	8	29	37		
	Total	8	49	57		
4	Normal	0	23	23	-0.332	0.012*
	Abnormal	8	26	34		
	Total	8	49	57		
5	Normal	0	28	28	-0.397	0.003*
	Abnormal	8	21	29		
	Total	8	49	57		
6	Normal	0	30	30	-0.426	0.001*
	Abnormal	8	19	27		
	Total	8	49	57		
7	Normal	0	33	33	-0.474	<0.001*
	Abnormal	8	16	24		
	Total	8	49	57		
8	Normal	0	34	34	-0.491	<0.001*
	Abnormal	8	15	23		
	Total	8	49	57		
9	Normal	0	37	37	-0.550	<0.001*
	Abnormal	8	12	20		
	Total	8	49	57		
10	Normal	0	38	38	-0.571	<0.001*
	Abnormal	8	11	19		
	Total	8	49	57		
11	Normal	0	41	41	-0.647	<0.001*
	Abnormal	8	8	16		
	Total	8	49	57		
12	Normal	0	45	45	-0.782	<0.001*
	Abnormal	8	4	12		
	Total	8	49	57		
13	Normal	1	46	47	-0.743	<0.001*
	Abnormal	7	3	10		
	Total	8	49	57		
14	Normal	1	46	47	-0.743	<0.001*
	Abnormal	7	3	10		
	Total	8	49	57		
15	Normal	1	47	48	-0.795	<0.001*
	Abnormal	7	2	9		
	Total	8	49	57		
20	Normal	4	49	53	-0.680	<0.001*
	Abnormal	4	0	4		
	Total	8	49	57		

EAT-10 – Eating Assessment Tool-10; NDST – Nursing Dysphagia Screening Tool; phi – association coefficient phi; * – statistically significant ($p < 0.05$)

Table 4 Cross-tabulation of NDST8 by EAT3, EAT4 and EAT9 and the degree of association between selected items

Cut-off score	Item	NDST8 Normal	NDST8 Abnormal	Total	Phi Value	Phi p
	EAT3					
1	Normal	1	30	31	-0.541	<0.001*
	Abnormal	13	13	26		
	Total	14	43	57		
2	Normal	2	33	35	-0.552	<0.001*
	Abnormal	12	10	22		
	Total	14	43	57		
3	Normal	5	42	47	-0.701	<0.001*
	Abnormal	9	1	10		
	Total	14	43	57		
4	Normal	10	42	52	-0.399	0.003*
	Abnormal	4	1	5		
	Total	14	43	57		
	EAT4					
1	Normal	1	26	27	-0.460	0.001*
	Abnormal	13	17	30		
	Total	14	43	57		
2	Normal	1	32	33	-0.587	<0.001*
	Abnormal	13	11	24		
	Total	14	43	57		
3	Normal	5	39	44	-0.564	<0.001*
	Abnormal	9	4	13		
	Total	14	43	57		
4	Normal	12	42	54	-0.231	0.082
	Abnormal	2	1	3		
	Total	14	43	57		
	EAT9					
1	Normal	2	30	32	-0.481	<0.001*
	Abnormal	12	13	25		
	Total	14	43	57		
2	Normal	2	33	35	-0.552	<0.001*
	Abnormal	12	10	22		
	Total	14	43	57		
3	Normal	10	39	49	-0.239	0.071
	Abnormal	4	4	8		
	Total	14	43	57		
4	Normal	14	42	56	0.076	0.565
	Abnormal	0	1	1		
	Total	14	43	57		

EAT3 – Item 3 of the Eating Assessment Tool-10; EAT4 – Item 4 of the Eating Assessment Tool-10; EAT9 – Item 9 of the Eating Assessment Tool-10; NDST8 – Item 8 of the Nursing Dysphagia Screening Tool; phi – association coefficient phi; * – statistically significant ($p < 0.05$)

the EAT-10 and FEES. To assess dysphagia severity by the FEES, the researchers used three measures: the Pooling Score (PS), the Penetration-Aspiration Scale (PAS), and the Dysphagia Outcome and Severity Scale (DOSS) (Schindler et al., 2013, p. 720). The obtained Pearson product-moment correlation ranged from -0.487 (DOSS versus the I-EAT-10) to 0.312 (PS for liquids versus the I-EAT-10).

It is worth mentioning that the extreme value of the phi coefficient (± 1) occurs only in the case of consistent results (i.e., if each patient had both the NDST and EAT-10 result either normal or abnormal) as well as symmetric distributions of the results in the 2×2 contingency tables (Zysno, 1997, p. 41). However, the distribution of the results was quite asymmetric. Forty-nine (86%) patients had an abnormal and only 8 (14%) had a normal NDST result (Table 3). The distribution of the EAT-10

results depended on the cut-off score. The most symmetric distribution occurred for a cut-off score of 5 (28 patients normal and 29 patients abnormal EAT-10); the asymmetry of the distribution tended to increase with increasing cut-off scores (at its extreme, 53 patients had a normal and 4 had an abnormal EAT-10 result for a cut-off score of 20) (Table 3). Therefore, the interpretation of the phi coefficient is somewhat complicated: one cannot decide to what degree the value below ±1 is affected by the distribution asymmetry of the values (i.e., many patients normal and few patients abnormal and vice versa, few patients normal and many patients abnormal using each tool) or by inconsistent results (i.e., a patient having a normal EAT-10 and an abnormal NDST result and vice versa).

Despite the above mentioned uncertainty, based on the negative relationship across all the studied EAT-10 cut-off scores, it could be hypothesized that in fact the NDST may not be a good gold standard for the EAT-10 at all. In other words, it could be argued that the EAT-10 may provide distinct yet complementary information on dysphagia – after all, this kind of conclusion has been made by Schindler et al. (2013, p. 723). Still, it is striking that patients with high EAT-10 scores had a normal NDST result and vice versa, patients with abnormal NDST results across all eight items reported virtually no swallowing problems.

Having discussed the discrepancy between the overall EAT-10 and NDST results, the next question is whether the relationship between selected "similar" items of the two tools could be positive. However, in all but one case, the studied relationship between the swallow test (NDST8) and three items of the EAT-10 that focused on swallowing liquids (EAT3) and solids (EAT4) and on cough while eating (EAT9) were negative as well (Table 4). In fact, in one case, the negative relationship was strong (EAT3 with a cut-off score of 3 versus NDST8) (phi = -0.701; $p < 0.001$). For EAT4 versus NDST8 and EAT9 versus NDST8, the negative relationship was less pronounced. Only in one case (EAT9 with a cut-off score of 4 versus NDST8), the relationship was positive; however, it was negligible and statistically not significant (phi = 0.076; $p = 0.565$) (Table 4). For all three items of the Eating Assessment Tool-10, the negative relationship with NDST8 tended to become even more negative when the cut-off score was increased from 1 to 2 or 3, then it became less negative again (or, in one case, it became positive) when it was increased further still, to 4 (Table 4).

These negative relationships are perhaps even more surprising than the negative relationships obtained for the overall EAT-10 and NDST results. One possible reason could be that the subjective viewpoint is based on the patients' experience during eating actual food and drinking fluids. On the other hand, NDST8 consists of swallowing only a small amount (4 teaspoons) of a thickened liquid, which is a different situation after all. In addition, subjective accounts of seemingly "objective" experience (food and fluid consumption and the presence or absence of cough associated with eating) could be affected by the person's memory, emotions, attitudes, and so on.

Nonetheless, the above explanation is hardly plausible – the conclusion, then, is that the results do not provide evidence for criterion validity of the EAT-10. This interpretation would be in line with Speyer et al.'s (2014) conclusions. The authors studied selected questionnaires on functional health status in oropharyngeal dysphagia (including the EAT-10) using the COSMIN taxonomy of measurement properties for health-related patient-reported outcomes (Speyer et al., 2014; Mokkink et al., 2010). They concluded that the methodological quality of the EAT-10 is poor due to a number of weaknesses, namely in the area of internal consistency, reliability, and also content, structural, and criterion validity (Speyer et al., 2014, p. 8).

In summary, simply stating that the EAT-10 examines a different aspect of dysphagia compared with the NDST is not a substantiated conclusion of this study. Instead, as far as criterion validity is concerned, the EAT-10 should be compared with another "gold standard", possibly a self-report tool. Thus, the results of this study support Speyer et al.'s (2014, p. 10) concerns and their conclusion that the EAT-10 needs thorough psychometric re-evaluation before it could be recommended for use in clinical practice.

Conclusion

The study aimed to explore criterion validity of the Czech version of the EAT-10 by studying the relationship between the EAT-10 and a "gold standard", the Czech version of the NDST. The relationship was explored for the dichotomized overall EAT-10 and for three selected items that focused on problems associated with drinking and eating and on cough while eating.

The data revealed that for all the studied cut-off scores, the relationship between the dichotomized NDST and EAT-10 results was negative. Similarly, in all but one case, the relationship between the swallow test (NDST8) and three items of the EAT-10 that focused on swallowing liquids (EAT3) and solids

(EAT4) and on cough while eating (EAT9) were negative as well. Clearly, the results do not provide evidence for criterion validity of the EAT-10 using the NDST. The EAT-10 cannot be recommended for use in clinical practice without further research.

Ethical aspects and conflict of interest

The study was conducted in accordance with ethical recommendations according to the Declaration of Helsinki (2002). All participants were informed of the purpose of the study and agreed to be included in the research; they expressed this agreement by signing an informed consent form. Participation was voluntary and all data were treated as confidential. The authors declare that the study has no conflict of interest.

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