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Translation and linguistic validation of the Composite Autonomic Symptom Score COMPASS 31 in Danish

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ABSTRACT

INTRODUCTION. The Composite Autonomic Symptom Score (COMPASS 31) is a validated self-assessment questionnaire quantifying the severity and distribution of autonomic symptoms across six domains (orthostatic intolerance, vasomotor, secretomotor, gastrointestinal, bladder and pupillomotor functions) by scoring 31 clinically selected questions. The aim of this study was to translate into Danish and validate the Danish version of COMPASS 31.

METHODS. The original (US) English version of the COMPASS 31 questionnaire was translated into Danish via forward/backward translation and validated in accordance with a protocol set forth by the Autonomic Group at the Mayo Clinic. Ten healthy controls and 20 patients with disorders associated with a variable degree of autonomic dysfunction were enrolled – all bilingual (Danish mother tongue, proficiency in English).

RESULTS. A total of 20 patients (16 women, aged 48 + 17 years) and ten healthy controls (six women, aged 40 + 19 years) were included. Test-retest reliability was high with no consistent bias, and the Danish version of the COMPASS 31 significantly correlated with the English version of the COMPASS 31 in both total score and all sub-scores. Patients scored significantly higher on the COMPASS 31 questionnaire than healthy controls (34.0 (26.5-49.2) versus 2.3 (1.6-24.3) (median (interquartile ranges); p = 0.01).

CONCLUSIONS. We present a Danish version of the COMPASS 31 – a validated self-reported questionnaire allowing for the quantification of autonomic dysfunction. We hope this Danish version will be implemented in both clinical practice and research settings in Denmark.

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The autonomic nervous system (ANS) is central in the physiology and homeostasis of the human body. Both subsystems of the ANS, the parasympathetic nervous system and the sympathetic nervous system, monitor and regulate most of our cells, tissues and organs - often in an antagonistic interplay. The ANS is centrally located in the reflex arcs, and negative feed-back mechanisms that regulate bodily functions thereby maintain an optimal internal environment [1].

The clinical features of autonomic dysfunction are therefore pervasive and often involve both the

cardiovascular, urogenital, gastrointestinal, thermoregulatory, sudomotor and pupillomotor systems [2].

The Composite Autonomic Symptom Score (COMPASS 31) is a validated self-assessment questionnaire quantifying the severity and distribution of autonomic symptoms across six domains (orthostatic intolerance, vasomotor, secretomotor, gastrointestinal, bladder and pupillomotor functions) by scoring 31 clinically selected questions [3]. It was developed to detect and quantify the degree of autonomic failure, to monitor disease progression and to evaluate response to treatment. The COMPASS 31 was developed by the Mayo Clinic Autonomic Group. They simplified and made a statistically strong version based on the more time-consuming 169-item instrument coined the Autonomic Symptom Profile [2, 3] and the 72-item COMPASS [4]. The total score of the COMPASS 31 questionnaire ranges 0-100 with higher values mirroring more severe symptoms of autonomic dysfunction [3].

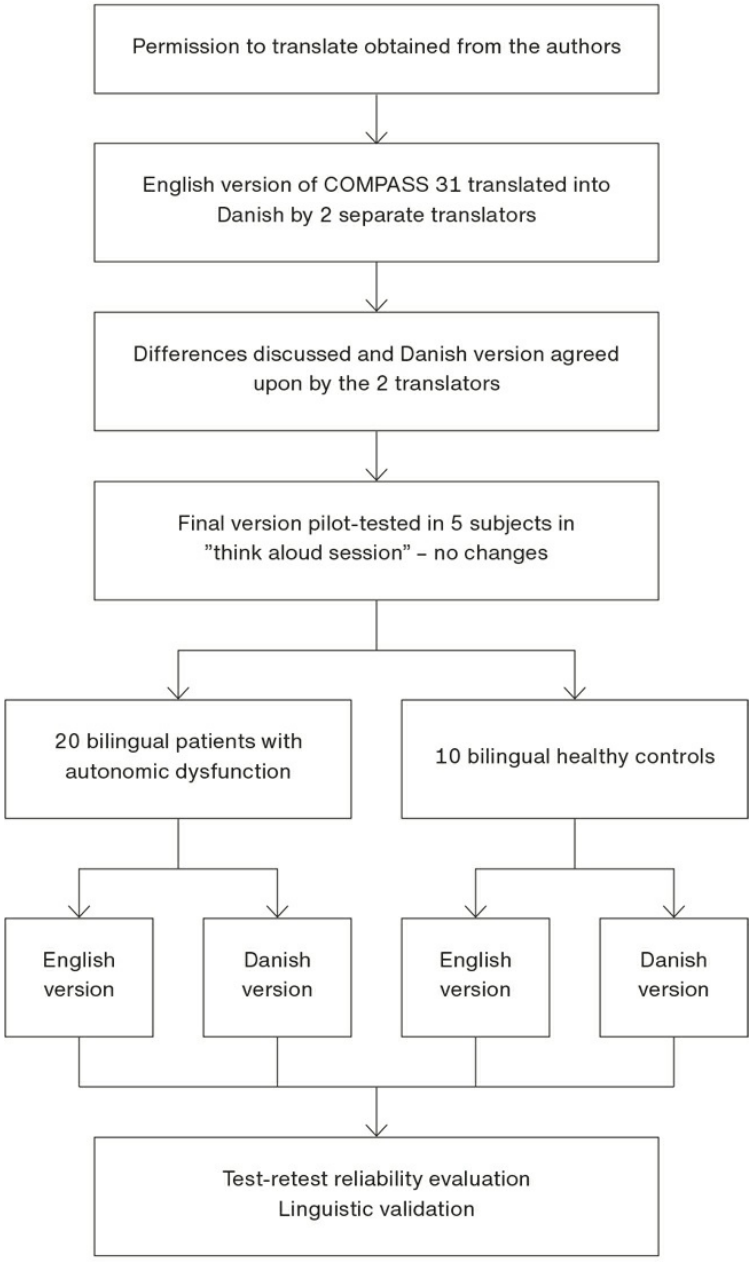
Since the creation of the COMPASS 31 questionnaire, extensive validation studies have been conducted in more than 800 patients and normal controls – demonstrating a clear separation of patient groups and association with laboratory indices of autonomic function [5-7].

A clinical questionnaire in Danish for the evaluation and quantification of symptoms suggesting autonomic dysfunction has been requested across an array of patient groups ranging from diabetes to Parkinson disease and psychiatric illnesses. The aim of this study was to derive an expert translation of the COMPASS 31 into Danish and qualify this through backtranslation using bilingual speakers (English as second language) and then evaluate the adjusted translation for reliability and convergent validity by relating scores derived from the translated version to the original English version of the COMPASS 31 in bilingual patients with different degrees of autonomic failure and healthy bilingual control subjects.

METHODS

The original (US) English version of the COMPASS 31 questionnaire was translated into Danish by two specialists in ANS disorders (LB and JM) working independently of each other. Subsequently, LB and JM collaborated to produce a single Danish version. This Danish version was then back translated into English by a bilingual Danish/English translator. Subsequently, LB and JM evaluated the back-translated version and produced a final Danish version. This final version was then pilot tested in five healthy controls – which did not lead to any changes. The translated questionnaire was then tested for convergent validity following a protocol set forth by the Autonomic Group at Mayo Clinic (**Figure 1**).

FIGURE 1 Flow chart of the translation and linguistic validation process.



COMPASS = Composite Autonomic Symptom Score.

The study protocol was approved to hold patient health data by the Danish Data Protection Agency (no. 2012-58-0004). Ethical approval was not deemed necessary. Both patients and healthy controls were recruited at the Syncope Centre at Bispebjerg Frederiksberg Hospital, which is part of the Copenhagen University Hospitals in Denmark. All participants provided written informed consent before entering the study. Ten healthy controls and 20 patients with disorders associated with variable degrees of autonomic dysfunction were enrolled (**Table 1**). All patients presented with symptoms compatible with some degree of autonomic dysfunction. All the included patients had tilt table test, Valsalva maneuver and metronomic breathing performed. All demonstrated some measure of orthostatic intolerance and/or autonomic dysfunction in these tests.

TABLE 1 Diagnoses of the 20 enrolled patients.

Diagnosis	n
Postural tachycardia syndrome	4
Diabetic neuropathy	3
Idiopathic orthostatic hypotension	2
Parkinson's disease	2
Neurocardiogenic syncope	2
Migraine headache	1
Myalgic encephalomyelitis/chronic fatigue syndrome	6

All were Caucasians and only bilingual participants were selected (Danish mother tongue, proficiency in English). Subjects were enrolled from June 2015 to April 2017. Because of the time gap between administrations of the two versions of the COMPASS 31 questionnaire, only patients with a relatively stable disease course and no recent major changes in management were included (i.e. no recent infections, new diseases or recent changes in medication). To assess the validity and the reproducibility, the same groups of patients and healthy controls completed the COMPASS 31 questionnaire twice, four weeks ± 1 week apart, once in Danish and once in English. The versions were completed in random order. The patient responses were entered into a designated Redcap database. The COMPASS 31 questionnaire was scored as recommended in the original publication [3].

Test-retest reliability of the English and Danish versions of the COMPASS 31 questionnaire was evaluated by a Bland-Altman plot. The validation analysis correlated both total scores and sub-scores derived from the English and Danish versions of the COMPASS 31 questionnaire using Kendall's tau due to the non-parametric nature of the data. Descriptive statistics of derived scores and sub-scores were also calculated. Significance was set to a p-value < 0.05.

Trial registration not relevant.

RESULTS

A total of 20 patients (16 women, aged 48 + 17 years) and ten healthy controls (six women, aged 40 + 19 years) were included. No significant differences in age and gender were observed between the two groups. All included subjects completed both questionnaires within the given time span.

The Bland-Altman plot demonstrated good test-retest reliability with no consistent bias of one version of the COMPASS 31 questionnaire versus the other (Figure S1 Supplementary files https://ugeskriftet.dk/files/a07210576_supplementary.pdf)

The Danish version of the COMPASS 31 significantly correlated with the English version of COMPASS 31 on both total score and all sub-scores (**Figure 2** and **Table 2**). The correlation for the overall score between the English and Danish version was 0.88 (Kendall's tau, $p < 0.01$). Correlation between sub-scores for the six domains is given

in Table 2. All correlations were significant at the 0.01 level (two-tailed). Test-retest reliability was good with no consistent bias of one version of the COMPASS 31 questionnaire versus the other (Figure S1 Supplementary files https://ugeskriftet.dk/files/a07210576_supplementary.pdf).

FIGURE 2 Correlations between total scores of English and Danish versions of the Composite Autonomic Symptom Score (COMPASS) 31.

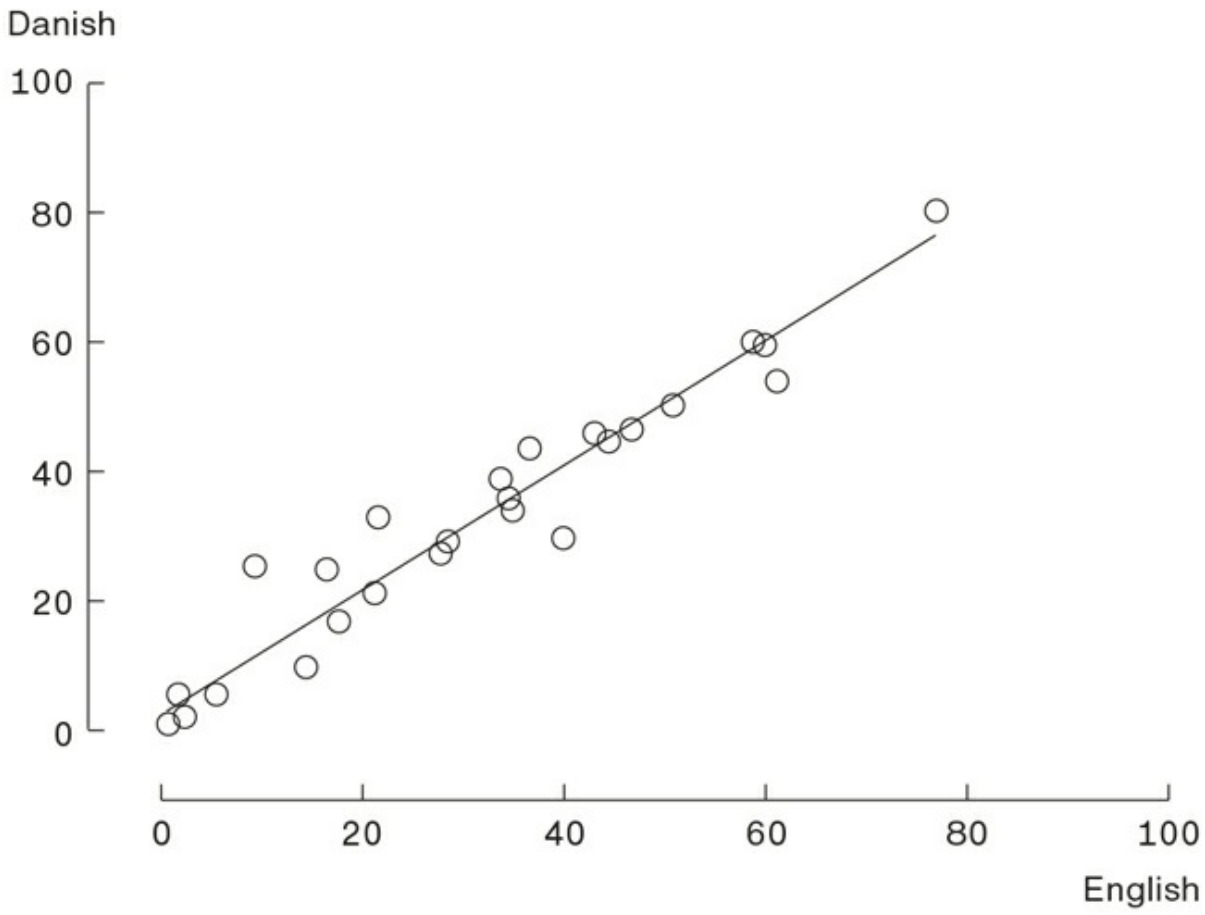


TABLE 2 Correlations[a] between obtained total score as well as subscores of the English and Danish versions of the Composite Autonomic Symptom Score (COMPASS) 31 questionnaire.

	English						
Danish	**COMPASS_31**	**OI_domain**	**VAS_domain**	**SEC_domain**	**GI_mixed_domain**	**BLA_domain**	**PUP_domain**
COMPASS_31	0.879*						
OI_domain		0.811*					
VAS_domain			0.857*				
SEC_domain				0.805*			
GI_mixed_domain					0.819*		
BLA_domain						0.800*	
PUP_domain							0.849*

BLA = bladder; GI = gastrointestinal; OI = orthostatic intolerance; PUP = pupillomotor; SEC = secretomotor; VAS = vasomotor.
*) $p < 0.01$ (2-tailed).
a) Correlations given by Kendall's tau.

As expected, patients scored significantly higher on the COMPASS 31 questionnaire than did healthy controls (34.0 (26.5-49.2) versus 2.3 (1.6-24.3) (median (interquartile ranges); $p = 0.01$) calculated from the mean values of the English and Danish score.

DISCUSSION

COMPASS 31 is a validated self-reported questionnaire allowing for the quantification of autonomic dysfunction as well as monitoring of treatment response and disease progression. In this study, we validated a Danish version and demonstrated significant correlations between the English and the Danish version across all domains. Unsurprisingly, patients scored significantly higher in the COMPASS 31 than healthy controls.

The scores obtained in our study compare well with those of previous studies using the COMPASS 31 in patients with possible autonomic dysfunction. In their study on diabetics using COMPASS 31, Greco et al. found the total weighted score in those with cardiovascular autonomic or polyneuropathy to be 29.9 ± 19.5 and 28.9 ± 19.1, respectively [6]. The study by Treister et al. found a mean score of 30.2 ± 23.2 in 66 patients with small-fibre neuropathy [7].

Having only performed a linguistic validation of the COMPASS 31 may be a concern with regard to the implementation of the questionnaire in research and daily clinical practice in Denmark. Our validation forms part of an international project initiated and coordinated by the autonomic group at the Mayo Clinic with the purpose of deriving validated translations of the COMPASS 31 in a multitude of different languages. The COMPASS 31 questionnaire has already been demonstrated to be a robust tool in the assessment of autonomic dysfunction symptom burden with scores that are well correlated with objective autonomic dysfunction test (haemodynamic response to head up tilt test and the Valsalva maneuver, heart rate response to deep breathing and sympathetic skin response) [8, 9]. The questionnaire was demonstrated to have good psychometric properties and was proven to be a valuable tool for quantification of autonomic dysfunction in diseases associated with dysfunction of the ANS, including Parkinson's disease [8], multiple system atrophy [8], postural orthostatic tachycardia syndrome [10], small-fibre neuropathy [7] and diabetes [6, 11].

We hope that future studies will evaluate the value of the Danish version of COMPASS 31 in a multitude of different diagnostic entities in Danish patients.

With the recent COVID-19 pandemic and the emerging evidence of autonomic dysfunction as part of a long COVID syndrome seen in a substantial part of COVID-19 survivors, the value of the COMPASS 31 for quick quantification of autonomic function is underscored [12].

CONCLUSIONS

We translated and validated a Danish version of the COMPASS 31. The COMPASS 31 is a valuable validated tool in the assessment of autonomic symptoms. We hope that the Danish version will be implemented in both clinical practice and research settings in Denmark.

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Conflicts of interest Potential conflicts of interest have been declared. Disclosure form provided by the author is available with the article at ugeskriftet.dk/dmj

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