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## Validity and reliability of the Disabilities of Arm, Shoulder, and Hand scale in dental students: A transnational study

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### ABSTRACT

This study aimed to evaluate the validity and reliability of the Disabilities of Arm, Shoulder, and Hand (DASH) scale in Brazilian and American dental students and assess the influence of demographic variables on disability in them. A cross-sectional observational study was conducted with a nonprobabilistic sample. The sample was composed of students of both genders from the School of Dentistry of Araraquara, State University of São Paulo (UNESP) ( $n = 288$ ), and students from Stony Brook University, New York, NY, USA ( $n = 149$ ). The disabilities of the upper limbs were estimated using the DASH scale. The samples were characterized by collecting information on gender, academic year, and sports and work activities. The refined bifactorial model presented goodness-of-fit indices for both countries. There was a significant effect of the variables *gender* and *academic year* for the Brazilian sample and the variable *sports practices* for the American sample. The refined bifactorial model was valid and reliable for the Brazilian and American populations. In this model, the removal of item 17 for the Brazilian sample and items 3, 13, and 23 for the American sample was necessary. Demographic variables such as gender, academic year, and sports practice contributed significantly to the level of disability in the study populations.

### ARTICLE HISTORY

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### KEYWORDS

DASH; dental students; ergonomics; musculoskeletal disorders; upper extremity

Work-related musculoskeletal disorders are a public health problem because they may lead to disability.<sup>1,2</sup> These injuries primarily affect the upper limbs.<sup>3</sup> There are several methods to measure disability among individuals, such as clinician-administered tools, clinician observations, and self-report instruments.<sup>4</sup> Self-report methods have been recommended to measure disability in a large number of people<sup>5–8</sup> because they require less time<sup>9</sup> and are less costly than objective methods.

The Disabilities of the Arm, Shoulder, and Hand (DASH) scale is a self-report questionnaire that has been developed to quantify disability, particularly in terms of physical functioning, and symptoms in a wide variety of upper-extremity conditions.<sup>10</sup> This instrument was originally composed of 30 items arranged in a unifactorial theoretical structure and is based on physical, social, and psychological theory.

The DASH questionnaire quantifies disability and symptoms that are abstract or theoretical constructs. Thus, its psychometric properties need to be evaluated to ensure the reliability and validity of the data obtained.<sup>11</sup> These psychometric measurements are correlated specifically with the population evaluated and are not a characteristic of the instrument.<sup>11–13</sup>

The DASH scale has been used in various countries to measure disability in individuals in different occupations and in patients clinically diagnosed with diseases of the musculoskeletal system.<sup>3,14–22</sup> However, to date, this instrument has not been applied to dentists and dental students, who are highly susceptible to musculoskeletal diseases of the upper limbs.<sup>10,23–26</sup>

Therefore, this study aimed to evaluate the validity and reliability of the DASH scale with Brazilian and American students and assess the influence of gender and academic year on disability, sports practices, and work activities on their musculoskeletal functioning.

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## Methods

### Study design and population

This cross-sectional observational study was conducted with a nonprobabilistic sample. The sample was composed of students of both genders from the School of Dentistry of Araraquara, State University of São Paulo (UNESP) ( $n = 288$ ), and from Stony Brook University, New York, New York, USA ( $n = 149$ ).

Kim<sup>27</sup> suggested the calculation of a minimum sample size by the power of the test. Therefore, considering an alpha of 5%, power of 80%, and the degrees of freedom of the model ( $df = 404$ ), the minimum sample size estimated for this study was 77 participants in each group. The present study was also educational; therefore, all students were encouraged to participate. Consequently, the sample size was higher than the minimum sample size calculated, and it did not compromise the analyses. However, if the sample size was lower than the minimum sample size, the analyses could have been compromised.

### Variables and tools

The samples were characterized by collecting information on gender, academic year, and sports and work activities. The disabilities of the upper limbs were estimated using the DASH scale.

The DASH instrument was adapted to Brazilian Portuguese by Orfale et al<sup>20</sup> and was used to measure the disability of the arms, shoulders, and hands in Brazilian students. The original version in English was proposed by Hudak et al<sup>7</sup> and used for American students. Both versions were composed of 30 items, with a 5-point Likert scale (1 = *no difficulty*; 5 = *unable*).

This study tested 3 different factorial models. The first model was a trifactorial structure based on the theoretical concept used by the Upper Extremity Collaborative Group (UECG) in the development of the DASH scale.<sup>28</sup> According to the scale developers, disabilities related to the upper limbs are measured on three aspects: physical function, symptoms, and social function. The second model was a bifactorial structure, where the physical function and the symptoms/social function were assessed. The third model was a unifactorial structure, considered as a reference by the UECG when applied to a sample of individuals with different musculoskeletal disorders.<sup>28</sup>

### Data collection and ethical considerations

The self-report instrument was completed by the students in the classroom, in the presence of the researcher. The present study was approved by the Human Research Ethics Committee of the School of Dentistry of Araraquara at UNESP

(CAAE No. 26051513.5.0000.5416) and the School of Dentistry at Stony Brook University (CORIHS #2014–2839-F).

### Statistical analysis

#### Psychometric sensitivity

Psychometric sensitivity was evaluated using measurements of summary and shape. Sensitivity was considered appropriate when skewness was  $<3$  and kurtosis was  $<7$ , in terms of their absolute values.<sup>29</sup>

#### Construct validity

The construct validity of the DASH scale was estimated by determining the factorial and convergent validities. A confirmatory factorial analysis (CFA) was performed to estimate the factorial validity using a polychoric correlation matrix and MPLUS software version 6.0 (Muthén and Muthén, Los Angeles, CA, USA). The Tucker-Lewis index (TLI), goodness-of-fit index (GFI), root mean square error of approximation (RMSEA), and chi-square/degrees of freedom ratio ( $\chi^2/df$ ) were used as indices of the quality of fit. The overall fit was considered appropriate if  $\chi^2/df \leq 4.0$ , TLI  $\geq 0.90$ , GFI  $\geq 0.90$ , RMSEA  $\leq 0.10$ , and  $\lambda \geq 0.40$ .<sup>11</sup> In cases in which appropriate indices were not obtained, the structure was refined using Lagrange multipliers ( $<11$ ).<sup>30</sup>

Convergent validity was estimated using the average extracted variance (AVE),<sup>11</sup> and this variable was considered appropriate if  $AVE_j \geq 0.50$ .

The discriminant validity was estimated by correlation analysis<sup>11</sup> between the factors and was considered adequate if  $AVE_i$  and  $AVE_j \geq r_{ij}$ .<sup>14</sup>

#### Internal consistency

Internal consistency was calculated using the standardized Cronbach's alpha coefficient ( $\alpha$ ) and the composite reliability (CR) and was considered appropriate when  $\alpha \geq 0.70$  and  $CR_j \geq 0.70$ .<sup>11</sup>

#### Causal model

A causal model was developed using structural equation modeling to assess the influence of gender, academic year, sports practices, and work activities on scores on the DASH scale of dental students. The model was evaluated in 2 stages using the MPLUS software version 6.0 (Muthén and Muthén). During the first stage, the quality of fit of the model was evaluated using the  $\chi^2/df$ , the comparative fit indices (CFIs), TLI, and RMSEA. The model fit was considered appropriate using the same parameters adopted in the instrument validation process.<sup>11</sup> During the second stage, the contribution ( $\beta$ ) and significance of causal trajectories were evaluated using the Z test. The significance level was determined to be 5%.

**Table 1.** Assessment characteristics of the participating students.

Variable	Country					
	Brazil <i>n</i> = 288		United States <i>n</i> = 149		Total <i>N</i> = 437	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Gender						
Female	218	75.7	82	55.0	300	68.6
Male	70	24.3	67	45.0	137	31.4
Academic year						
1st	57	19.8	41	27.5	98	22.4
2nd	64	22.2	39	26.2	103	23.6
3rd	65	22.6	37	24.8	102	23.3
4th	53	18.4	32	21.5	85	19.5
5th	49	17.0	—	—	49	11.2
Sport activities						
No	126	43.8	44	29.5	170	38.9
Yes	162	56.3	105	70.5	267	61.1
Work activities						
No	254	88.2	130	87.2	384	87.9
Yes	34	11.8	19	12.8	53	12.1

## Results

Table 1 presents the demographic characteristics of the study populations.

We observed that in Brazil and the United States, most study samples were composed of female students who practiced sports but did not perform work activities.

Table 2 presents the measurements of summary and shape of distributions of DASH's items.

The average values of the DASH scale items varied between 1.040 ( $\pm 0.209$ ) and 2.280 ( $\pm 1.095$ ). Regarding skewness and kurtosis, the values of items 13 and 17, respectively, were higher than the recommended values.

Table 3 presents the goodness-of-fit indices according to the factorial structure of the countries evaluated.

We observed that the trifactorial structure of both samples presented multicollinearity between 2 factors ( $r_{\text{Brazil}} = 1.021$ ;  $r_{\text{USA}} = 0.985$ ). The complete model used in the United States was not refined, despite the poor fit (Table 2), whereas the complete model used in Brazil presented a good fit and was not refined. With respect to the bifactorial structure, the complete models used in these 2 countries did not present a good fit. Therefore, both models were refined. The complete and refined models did not present a good fit in the unifactorial structure. Regarding convergent validity, AVE was close to or within values considered appropriate ( $\text{AVE} \geq 0.5$ ) and CR was within values considered appropriate ( $\text{CR} \geq 0.7$ ) for all structures evaluated in Brazil and the United States. Discriminant validity was limited only in the trifactorial structure, for both countries. The internal consistency was also close to values considered appropriate

**Table 2.** Psychometric sensitivity of the DASH instrument.

Item	Samples											
	Mean			Standard deviation ( $\pm$ )			Skewness			Kurtosis		
	Brazil	USA	Total	Brazil	USA	Total	Brazil	USA	Total	Brazil	USA	Total
01	2.280	1.660	2.070	1.095	0.812	1.049	0.545	0.936	0.736	0.429	0.138	0.175
02	1.100	1.100	1.100	0.387	0.398	0.390	4.635	4.739	4.657	25.568	25.412	25.210
03	1.040	1.060	1.050	0.209	0.266	0.230	5.943	4.767	5.445	38.663	24.582	32.181
04	1.120	1.180	1.140	0.409	0.494	0.440	3.928	2.756	3.415	16.796	6.701	11.865
05	1.670	1.460	1.590	0.733	0.631	0.706	0.774	1.065	0.878	0.173	0.062	0.057
06	1.350	1.330	1.340	0.606	0.672	0.628	1.647	2.203	1.871	2.014	4.563	3.093
07	1.690	1.350	1.570	0.825	0.614	0.776	0.966	1.571	1.168	0.940	1.322	0.524
08	1.780	1.430	1.660	0.959	0.710	0.896	1.103	1.921	1.340	0.512	4.554	1.310
09	1.070	1.130	1.090	0.286	0.553	0.398	4.165	4.665	5.368	18.331	23.440	34.885
10	1.450	1.520	1.480	0.692	0.750	0.712	1.402	1.528	1.456	1.271	2.179	1.670
11	1.820	1.460	1.690	0.854	0.721	0.828	0.836	1.469	1.013	0.003	1.374	0.272
12	1.590	1.280	1.490	0.851	0.658	0.803	1.477	2.505	1.731	1.830	5.877	2.617
13	1.130	1.040	1.100	0.418	0.282	0.379	3.689	8.737	4.558	14.887	85.319	23.545
14	1.280	1.270	1.280	0.585	0.674	0.616	2.273	3.374	2.761	5.312	13.496	9.211
15	1.110	1.070	1.100	0.346	0.331	0.341	3.217	4.800	3.688	10.421	23.392	13.954
16	1.050	1.050	1.050	0.231	0.280	0.248	5.045	5.675	5.397	27.354	33.673	31.429
17	1.050	1.110	1.070	0.265	0.452	0.341	5.592	5.776	6.375	33.143	40.698	51.830
18	1.680	1.340	1.570	0.798	0.601	0.753	1.012	1.764	1.232	0.627	2.883	1.135
19	1.320	1.210	1.280	0.567	0.536	0.558	1.742	3.070	2.126	2.635	10.572	4.643
20	1.120	1.130	1.120	0.391	0.511	0.435	3.857	5.143	4.646	17.133	30.309	26.608
21	1.100	1.130	1.110	0.345	0.600	0.448	3.637	5.073	5.252	13.575	26.878	33.372
22	1.190	1.120	1.160	0.507	0.418	0.479	2.863	4.170	3.193	7.931	20.107	10.505
23	1.190	1.120	1.170	0.474	0.401	0.451	2.505	3.510	2.769	5.593	12.112	7.067
24	1.490	1.400	1.460	0.756	0.697	0.736	1.803	1.691	1.774	3.730	2.186	3.342
25	1.550	1.440	1.510	0.740	0.691	0.725	1.133	1.665	1.290	0.495	2.653	1.039
26	1.200	1.230	1.210	0.537	0.659	0.581	2.973	3.886	3.462	9.323	17.083	14.015
27	1.260	1.260	1.260	0.546	0.638	0.578	2.400	2.722	2.555	6.642	7.124	6.981
28	1.150	1.190	1.160	0.537	0.484	0.448	2.975	2.615	2.834	8.429	6.110	7.440
29	1.150	1.170	1.160	0.423	0.499	0.450	2.856	3.301	3.083	7.790	11.337	9.780
30	1.320	1.280	1.300	0.766	0.658	0.730	2.677	2.361	2.617	6.872	4.782	6.573

**Table 3.** Goodness-of-fit indices (local and global) of models evaluated.

Structure	Country	N	Model	Removed items	$\Lambda$	$\chi^2/df$	CFI	TLI	RMSEA	r	AVE	CR	$\alpha$	WRMR
Trifactorial	Brazil	288	Complete	—	0.550–0.876	1.62	0.945	0.940	0.046	0.612–1.021	0.429–0.673	0.772–0.939	0.609–0.859	1.193
	USA	149	Complete	—	0.336–0.918	2.06	0.866	0.874	0.085	0.696–0.985	0.490–0.750	0.859–0.950	0.652–0.864	1.611
Bifactorial	Brazil	288	Complete	—	0.355–0.903	1.62	0.945	0.941	0.046	0.626	0.429–0.465	0.650–0.939	0.859–0.871	1.192
	USA	149	Complete	17	0.550–0.903	1.71	0.941	0.937	0.050	0.626	0.444–0.635	0.939–0.941	0.853–0.871	1.217
Unifactorial	Brazil	288	Complete	—	0.338–0.906	2.06	0.866	0.855	0.084	0.732	0.491–0.532	0.710–0.950	0.864–0.895	1.616
			Refined	3, 13, 23	0.414–0.904	1.73	0.922	0.915	0.070	0.721	0.535–0.726	0.954–0.955	0.867–0.884	1.317
			Complete	—	0.331–0.833	2.35	0.880	0.871	0.068	—	0.423	0.955	0.892	1.575
			Refined	17	0.516–0.833	2.54	0.873	0.863	0.073	—	0.434	0.956	0.895	1.611
	USA	149	Complete	—	0.359–0.880	2.27	0.839	0.827	0.092	—	0.510	0.968	0.911	1.747
			Refined	3, 13, 23	0.524–0.879	2.03	0.898	0.889	0.083	—	0.549	0.969	0.910	1.484

Note. df = degrees of freedom; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; AVE = average extracted variance; CR = composite reliability; CFI = comparative fit index; WRMR = weighted root mean square residual.

**Table 4.** Summary of structural equation modeling.

Country	Factor	Variable	B	$\beta$ standardized	Standard error	p value
Brazil	Physical function	Gender	0.434	0.336	0.067	<.001
		Academic year	0.136	−0.326	0.055	<.001
		Sports practices	0.103	−0.088	0.059	0.137
		Work activities	0.013	0.007	0.069	.915
	Symptoms/social function	Gender	0.351	0.156	0.074	.028
		Academic year	0.066	−0.098	0.072	.173
		Sports practices	0.010	−0.005	0.073	.943
		Work activities	0.141	0.049	0.081	.546
USA	Physical function	Gender	0.087	0.104	0.101	.307
		Academic year	0.025	0.066	0.112	.555
		Sports practices	0.191	−0.223	0.103	.020
		Work activities	0.154	−0.123	0.231	.595
	Symptoms/social function	Gender	0.057	0.035	0.108	.747
		Academic year	0.065	0.088	0.122	.473
		Sports practices	0.001	−0.001	0.108	.995
		Work activities	0.136	0.056	0.110	.614

( $\alpha \geq 0.7$ ) in the trifactorial model in both countries and presented appropriate values in the remaining models.

On the basis of the data presented in Table 3, DASH's bifactorial structure was selected for use in the causal model with the Brazilian and American samples. The bifactorial and trifactorial models presented a good fit in Brazil; however, the trifactorial model was not used because of the multicollinearity between factors *symptoms* and *social function* ( $r = 1.021$ ). Only the bifactorial model presented adequate local and global adjustments for the American samples.

Table 4 presents the contribution of the demographic variables evaluated on the latent DASH factors in the bifactorial model in each country.

There was a significant effect of the variables *gender* and *academic year* on the factor *physical function* and the variable *gender* on *symptoms/social function* in the Brazilian sample and the variable *sports practices* on *physical function* in the American sample.

Figure 1 presents the causal model of the variables with a significant contribution in the Brazilian sample.

The academic year influenced *physical function* in the Brazilian sample such that the higher the academic year, the lower was the level of disability (standardized  $\beta = -0.326$ ). Meanwhile, gender affected the factors *physical function* and *symptoms/social function*, and the female gender presented the highest degree of *physical disability* (standardized  $\beta = 0.336$ ) and *symptoms/social function* (standardized  $\beta = 0.156$ ).

Figure 2 presents the causal model of the variable with a significant contribution in the American sample.

In addition, only *sports practices* presented a significant contribution to *physical function* in the American samples, and individuals who practiced sports presented the lowest degrees of disability for this factor ( $-0.223$ ).

## Comment

This transnational study evaluated the psychometric characteristics of the DASH scale in a normative population of dental students of Brazil and the United States and assessed the influence of gender, academic year, sports practices, and work activities on disability in both groups.

We used the classical theory for process validation, although Franchignoni et al,<sup>31</sup> Cano et al,<sup>32</sup> and Forget et al<sup>33</sup> consider the Rasch analysis a more robust method. In the present study, 3 factorial proposals were tested for the DASH scale (uni, bi, and trifactorial), and since the Rasch analysis considers unidimensionality to be an important assumption, its use would not be feasible. Nevertheless, we used a strong program to validate the classical theory, which is considered a robust analysis; therefore, we believe data validity and reliability were ensured.

Most studies that applied the DASH scale used the unifactorial structure<sup>3,14,34–37</sup> proposed by the authors.<sup>7,28</sup> In this study, the unifactorial structure could not be adjusted for the Brazilian and American samples, even after refining. Cheng et al<sup>38</sup> and Franchignoni et al<sup>31</sup> found better data adjustment in the trifactorial model than in the present study, in which a high correlation was observed between 2 factors. Kennedy et al<sup>28</sup> evaluated the psychometric properties of the unifactorial and bifactorial models during the development of DASH; although the bifactorial model was found to have better psychometric properties than the other models, some items were saturated in both factors, and therefore, the authors decided to use the unifactorial model. In our study, the refined bifactorial model presented the best fit for both Brazilian and American students. However, our study population could be considered normative. Most studies that used the DASH scale obtained data from a

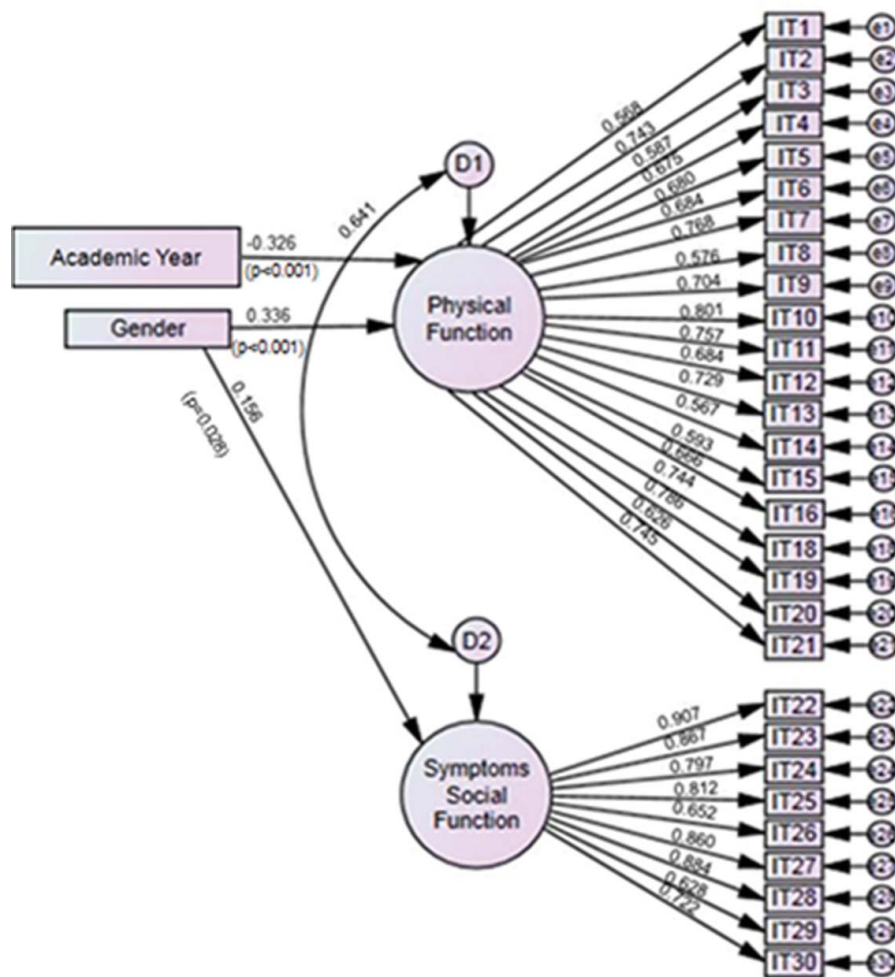


Figure 1. Causal model of Brazil with the significant contribution ( $p < .05$ ).

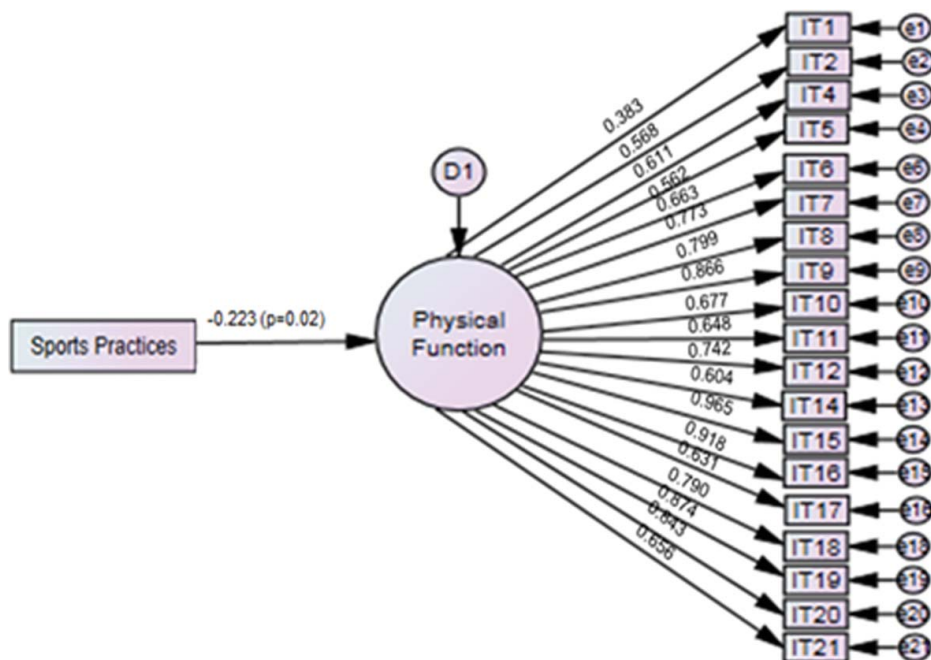


Figure 2. Causal model of the United States with a significant contribution ( $p < .05$ ).

sample of individuals with musculoskeletal disorders in the upper limbs, which might explain the differences between the observed factorial structures.

A good fit of the models was achieved by removing some items. However, only the bifactorial model obtained a good fit for the Brazilian and American samples. For the Brazilian sample, it was necessary to remove item 17 (recreational activities), and for the American sample, items 3 (turning keys), 13 (washing/drying the hair), and 23 (limitation in work activities because of the DASH scale), which resulted in the development of bifactorial models with a different item structure.

The DASH scale characteristics were different in samples from different countries with the same demographic features. This result indicates the importance of a validation study, which should be conducted before the use of the instrument. Hunsaker et al,<sup>39</sup> Cheng et al,<sup>38</sup> Franchignoni et al,<sup>31</sup> Lehman et al,<sup>36</sup> and Wang et al<sup>2</sup> also found a lack of local fit for some items (change of light bulbs, gender activity, burning sensation on the skin, and difficulty sleeping and driving). Only Cheng et al<sup>38</sup> excluded the item *turning keys*, and this item was removed from our models for the American population.

The item eliminated from the bifactorial model for the Brazilian sample relates to recreational activities and involves *playing cards* or *knitting*; this elimination can be explained by the characteristics of the study population, which belongs to a generation in which recreational activities are correlated primarily with the use of technology. In terms of the American sample, the students may have responded to the excluded items with “no difficulties were experienced” because they were considered easy to perform and this group did not have established musculoskeletal problems; in addition, this might have caused the “ceiling” effect, which, according to Forget et al,<sup>33</sup> might affect the capacity of measuring *symptoms/social function* in the DASH scale.

The effect of sociodemographic variables on *physical function* and *symptoms/social function* in the bifactorial model was evaluated after the structural model of the DASH scale was validated in the Brazilian and American populations, and good reliability values were obtained (Table 3); however, these variables contributed differently to the DASH scale in the 2 populations.

For the Brazilian sample, the academic year presented a significant contribution ( $p < .001$ ) only for *physical function*, such that the higher the academic year, the lower was the disability. Meanwhile, gender contributed significantly to *physical function* ( $p < .001$ ) and *symptoms/social function* ( $p = .028$ ), and women reported higher degrees of physical disability and symptoms than men. Similar results were found in studies conducted by Cheng et al<sup>38</sup> and Forget et al.<sup>33</sup> Greenslade et al,<sup>40</sup> Jester

et al,<sup>41</sup> and Forget et al<sup>33</sup> reported that these results might be explained by the items in the instrument because most items were related to domestic activities, which were primarily performed by women, including *making the bed* and *domestic tasks*. According to Hoofman et al,<sup>42</sup> a similar exposure to the same risk factor among men and women may have a greater effect on women due to biological differences (body size, muscular capacity, aerobic capacity, and hormonal conditions) or to psychological differences (such as coping strategies).<sup>43</sup> De Zwart et al<sup>44</sup> and Treaster and Burr<sup>45</sup> emphasize that biological differences, the number of tasks besides work, the way the task is performed, and a work position based on male anthropometric measures can make women more susceptible to complaints in the upper limbs. Another point to be considered is the higher awareness of women about health issues, which may allow them to develop a broader perspective and report issues related to their health.<sup>42,44</sup> In this study, the population studied was of university students, and therefore the issues related to domestic activities were not addressed.

Regarding the causal model obtained for American students, only *sports practice* had a significant effect on *physical function* ( $p = .020$ ) as sports practices were associated with lower scores. This result may be related to the American culture, which encourages students to participate in sports activities starting in elementary school, and according to Andersen et al,<sup>46</sup> the practice of sports might act as a protective factor against the development of disabilities by strengthening the musculoskeletal system.

In this study, the DASH scale structure and the influence of the variables *gender* and *academic year* on the construct that it evaluates differed between American and Brazilian students. The original DASH questionnaire is in English and was developed considering the American culture settings. As such, for American students, the DASH scale was culturally adapted. For the Brazilian students, it was adapted culturally by Orfale et al.<sup>21</sup> Thus, cultural differences were taken into account in the instruments applied to students of the 2 different countries. According to Atroshi et al,<sup>14</sup> the process of transcultural adaptation allows the observed differences between populations of different countries to reflect differences in their health status rather than differences caused by the translation of the instrument. Therefore, observed differences between American and Brazilian students reflect their cultural and behavioral context.

The main limitation of this study is that the cross-sectional design limits the possibility of observing causality between the variables. Thus, it is recommended that other studies with an analytical approach be conducted. Another possible limitation is the smaller sample size in

the American population and the selection of a convenience sample, which may hamper the generalization of the results.

Despite these limitations, to date, no study has used this scale for dental professionals and students, who are very susceptible to musculoskeletal problems in the upper limbs, and thus, the present study helped fill this gap and may enable more researchers to address problems pertaining to disability in dental professionals. Another significant contribution of this study was its transnational nature, which makes this study unique. The results obtained here indicate the need for caution in the use of psychometric scales because we observed that the psychometric characteristics of the DASH scale were distinct in populations of different nationalities. Considering that appropriate psychometric properties (ie, values that are closest to reality) will minimize measurement errors, conducting validity studies is essential for obtaining reliable data, which will guarantee the adoption of effective preventive and educational strategies.

## Conclusion

The refined bifactorial model was valid and reliable for the Brazilian and American populations. In this model, the removal of item 17 for the Brazilian sample and items 3, 13, and 23 for the American sample was necessary. In addition, demographic variables such as gender, academic year, and sports practice contributed significantly to the level of disability in the study populations.

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