



Original Article

Reliability and validity of Turkish version of the Scoliosis Japanese Questionnaire- 27 in patients with adolescent idiopathic scoliosis

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ABSTRACT

Background: The aim of this study was to evaluate the reliability and validity of an adapted Turkish version of the Scoliosis Japanese Questionnaire- 27 (SJ- 27).

Methods: Translation and retranslation of the English version of the SJ- 27 was conducted, and all steps of the cross-cultural adaptation process were performed. The Turkish version of the SJ- 27, the Scoliosis Research Society-22 (SRS- 22) questionnaire and the Short Form-36 (SF- 36) were performed to 139 patients with AIS. Reliability was assessed using the test–retest method (Pearson's correlation coefficient); internal consistency was analyzed using Cronbach's alpha. Validity was assessed by correlating the SJ- 27 with the SRS- 22 questionnaire and SF- 36.

Results: The mean Cobb angles were $23.2 \pm 8.3^\circ$ and $19 \pm 5.9^\circ$ for thoracic and lumbar regions, respectively. The SJ- 27 showed excellent test/retest reliability with an Intraclass correlation coefficient of 0.99. Internal consistency of the SJ- 27 was found to be very good (Cronbach's alpha = 0.991). The SJ- 27 demonstrated very good construct validity with the SRS- 22 total score ($r = 0.61$). The similar domains of the SJ- 27 and SF- 36 questionnaire was correlated also in the study.

Conclusions: The Turkish version of the SJ- 27 to measure health related quality of life in adolescent idiopathic scoliosis was found to have very good validity, excellent reliability, and high internal consistency.

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1. Introduction

Adolescent idiopathic scoliosis (AIS) is the most common spinal disorder in adolescents and its prevalence is 2%–3% in the general population [1]. Spinal deformity result in a significant deterioration of patient's health related quality of life (HRQOL). The quality of life is significantly affected by aesthetic self-perception, psychosocial problems due to body image disturbance or musculoskeletal problems along with spine deformity, decreased physical activity and back pain [2,3]. Therefore, it is important to evaluate the changes in HRQOL caused by deformity in adolescent patients with idiopathic scoliosis.

The patient-reported outcome instruments are increasingly common tools used to assess patients' HRQOL. The Scoliosis

Research Society- 22 (SRS- 22), Bad Sobernheim Stress Questionnaire, Brace Questionnaire, Short Form- 36 (SF- 36) are widely used patient-reported outcome instruments to assess quality of life in patients with AIS [4–7]. SRS- 22 is one of the most widely used questionnaire for evaluating HRQOL of patients with AIS and has been reported to have a high reliability and validity [8]. SRS- 22 is the only questionnaire with validity and reliability in Turkish, and the questionnaire was designed to assess the quality of life for children who had surgical treatment [9]. However, the question about the economic burden is also suboptimal for Turkish patients due to health insurance systems. Turkish version of SRS- 22 reported that the internal consistency of the question was poor and that this item was omitted from the version of the questionnaire [9]. In addition, Doi et al. reported that the self-image subscale questions in SRS- 22 were insufficient for the modest or reserved personality types observed in most Japanese people. On the other hand, the Bad Sobernheim Stress Questionnaire evaluates stress and feelings of the children treated with brace, while the Brace Questionnaire only investigate the effect of the brace on the quality of life [10,11]. Therefore, for a long time there has been need for a

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Turkish questionnaire that measures the quality of life in many ways in children with AIS. Doi et al. studied on scoliosis questionnaire to evaluate the quality of life in patients with scoliosis, and developed the Scoliosis Japanese Questionnaire- 27 (SJ- 27) to meet this needs [12].

SJ- 27 questionnaire was developed for evaluating HRQOL of patients with female AIS. The questionnaire covers five domains (pain, discomfort when wearing clothes, appearance, cognition, and participation). The SJ- 27 has been validated in Japanese and has shown good reliability (Cronbach alpha = 0.91) and discriminant validity [12]. This questionnaire is an alternative patient-reported outcome instrument to the SRS- 22 questionnaire, which we may use in Turkish population with idiopathic scoliosis for evaluating the HRQOL. The SJ- 27 has self-evident strengths as a comprehensive questionnaire and cover a wide range of HRQOL issue. Cross-cultural adaptations of SJ- 27 have not been completed for other languages. The aim of this study was to translate the SJ- 27 into Turkish and to validate the Turkish version (SJ- 27) for AIS patients.

2. Materials and methods

2.1. Translation and cultural adaptation process

The translation and cross-cultural adaptation of the original version of the SJ- 27 into Turkish were carried out in accordance with published guideline for cross-cultural adaptation of self-reporting methods by Beaton [13]. Two native Turkish speakers who are fluent in English and familiar with the terminology of the relevant test carried out independent translations of the SJ-27 from English to Turkish. The original version and the two translated versions were compared. After discussing the discrepancies of the translations, speakers reached a consensus, and the two versions were synthesized to common Turkish version. In the translation and cross-cultural adaptation process, some adaptations were made in order to apply the questionnaire regardless of the girls or the boys. In Q6, “waistline of a skirt” was added to “or pants”. In Q13, “father or brothers” was added to item. Next, 20 patients with AIS were randomly selected to assess the translation of each question was evaluated in terms of applicability and comprehensibility, and some minor changes were made for consistency. According to interviews, we modified the content of five questions on form to make them comprehensible to the current generation. In Q8, “the fit of T-shirts” was changed to “the position of T-shirts on your body”. In Q15, additional explanation was added to item: “about the curvature of your back”. In Q17, additional explanation was added to item: “do you think”. In Q23, “depressed” was changed to “depressed or pessimistic”. In Q25, “overly self-conscious” was changed to “obsessed”.

After this pilot study, the back translation was performed independently by two bilingual translators whose native language was English. Both back translators were blind to the original English version. The expert committee was created by the two initial translators and two back translators. The Turkish version and the back-translated English version were compared with the original English version to determine misunderstood questions and/or disagreements. The final version of the Turkish version of the SJ- 27 questionnaire was formulated by the expert committee and was agreed upon by the members of the expert committee.

2.2. Participants

The study was approved by the IRB of the authors' affiliated institutions (the start date of the study: 01/24/2019 and end date of the study: 02/13/2020) and all patients signed a written

informed consent form. A total of 139 patients who had been diagnosed with AIS through radiological and clinical evaluation, were included. To be included the following criteria were determined [1]: age between 10 and 18 years [2], Cobb angle > 10° and [3] native Turkish speakers. Patients who had cooperative impairment and inability to understand instructions were excluded from this study.

Demographic characteristics such as age, height, body weight, body mass index (BMI), gender, curve pattern, and curve magnitude of each patients was recorded. Curve magnitude (Cobb angle) and curve pattern for each patient was determined from standing frontal plane radiographs by the same physician. The curve patterns were single (including thoracic and thoracolumbar or lumbar regions) or double, including (double thoracic or thoracic-thoracolumbar/lumbar regions). The angle of vertebral rotation (AVR) was determined via a scoliometer as described by Bunnell [14]. Patients completed the SJ- 27 questionnaire twice over a test-retest interval of 7 days. In addition, all of the patients completed the following questionnaires, which are already available and validated in Turkish: SRS- 22 [9], SF- 36 [15].

2.3. Instruments

2.3.1. Scoliosis Japanese Questionnaire- 27 (SJ-27)

The SJ- 27 was developed to assess HRQOL of patients with AIS. The SJ- 27 consists of five domains and 27 items. The domains assessed by the SJ- 27 include four questions regarding back pain while lying down and after sitting or standing, or neck/shoulder stiffness or soreness (items 1–4), seven questions regarding discomfort while wearing clothes or holding bags (items 5–10 and 27), four questions regarding difficulties associated with participating in physical activities (items 11, 15, 16 and 19), six questions related to feelings of anxiety or depression due to the spinal deformity (items 17, 18, 20, 21, 23, and 24), and six questions regarding being self-conscious about one's appearance while in public (items 12–14, 22, 25, and 26). The 27 items are scored on a 5-point scale from no impairment (0 point) to severe impairment (4 points) and then added to yield a total score (0–108 points). Higher score indicates a much worse HRQOL. Previously, the SJ- 27 was found have high reliability (Cronbach alpha = 0.91) and discriminant validity [12].

2.3.2. The Scoliosis Research Society- 22 (SRS- 22)

The SRS- 22 is a standardized, disease-specific questionnaire that is dedicated to the assessment of pain, self-image, function and mental health in patients with idiopathic scoliosis. It consists of 22 items, each scored from 1, which is the worst situation, to 5, which is the best situation. The total score ranges from 1 to 5 [8,9].

2.3.3. The Short-Form Health Survey (SF-36)

The SF- 36 is the most commonly used 36 item self-report questionnaire which is used to evaluate the HRQOL. The SF- 36 produces eight scores on multi-item-scales: Physical functioning, physical role functioning, emotional role functioning, vitality, mental health, social functioning, bodily pain and general health perception. The scale of score ranges from 0 to 100, and higher scores indicate better health status [16,17].

2.4. Statistical analysis

All statistical analyses were conducted with SPSS (Version 22.00) statistical software program (SPSS Inc, Chicago, IL). The data was presented as the mean ± standard deviation, and the critical significance level was determined as $p < 0.05$. Independent samples t test was used to compare the results of the Turkish SJ- 27 of

the patients with AIS (n = 139). The test-retest reliability was assessed using intraclass correlation coefficient (ICC) using a two-way mixed model with under consistency. The ICC value range from 0.00 to 1.00, with values between 0.60 and 0.80 indicating a good reliability, and values more than 0.80 indicating excellent reliability. The internal consistency of the questions was evaluated using Cronbach's α value. Cronbach's α value was accepted as very good if the coefficient was larger than 0.80. The validity analysis using Pearson correlation values were considered as follows: excellent for 0.81–1.0, very good for 0.61–0.80, good for 0.41–0.60, adequate for 0.21–0.40, and weak for 0.00–0.20 [18].

3. Results

A total of 139 patients with AIS (mean age 14 ± 2.3 years; BMI: 19.6 ± 3 kg/m²) participated in this study. The average Cobb angle of the patients was $23.2 \pm 8.3^\circ$. Curve patterns of patients were single or double major. Treatment history was no treatment (49.6%), exercise (22.3%), brace (25.2%) and surgery (2.9%). Demographic and clinical characteristics of the patients with the mean scores of each scale are presented in Table 1.

Table 1
Demographic and clinical characteristics of patients, and mean scores of each scale.

Characteristics	Patients (n = 139) Mean (SD)	Min-max
Age (years)	14 (2.3)	10–18
Height (cm)	159.2 (8.5)	140–182
Body weight (kg)	50 (10)	34–93
Body mass index (kg/m ²)	19.6 (3)	14.3–34.2
Menarche (years)	2.9 (2)	0.25–7
Gender n (%)		
Male	14 (10.1)	N/A
Female	125 (89.9)	
Cobb angle-thoracic (°)	23.2 (8.3)	10–47
Cobb angle-lumbar (°)	19.0 (5.9)	8–36
AVR- thoracic (°)	5.0 (3.6)	0–16
AVR- lumbar (°)	3.3 (1.9)	0–10
Curve pattern n (%)		
Single curve	93 (68.4)	
Double major curve	43 (31.6)	N/A
Treatment recommendation n (%)		
No treatment	69 (49.6)	N/A
Exercise	31 (22.3)	
Brace	35 (25.2)	
Surgery	4 (2.9)	
SJ- 27		
Pain	4.2 (3.3)	0–16
Discomfort	7.4 (5.0)	0–24
Participation	4.9 (3.5)	0–13
Appearance	6.8 (4.9)	0–24
Cognition	10.6 (4.4)	2–23
Total	33.8 (17.2)	9–93
SRS- 22		
Pain	4.2 (0.7)	2.4–5
Self-image/appearance	3.4 (0.6)	1.8–5
Function/activity	4.4 (0.6)	2.6–5
Mental health	3.6 (0.8)	1–5
Satisfaction with treatment	4.4 (0.7)	2.5–5
Total	4.0 (0.5)	2.2–4.9
SF- 36		
Physical functioning	82.9 (20.6)	15–100
Physical Role Functioning	77.0 (34.8)	0–100
Emotional role functioning	75.8 (36.1)	0–100
Vitality	62.6 (21.4)	10–100
Mental health	64.3 (24.4)	12–100
Social functioning	84.2 (23.3)	0–100
Bodily pain	76.6 (23.5)	0–100
General health perception	61.2 (20.1)	10–100

Data presented as mean (standard deviation), SJ- 27: Scoliosis Japanese Questionnaire- 27, SRS- 22: Scoliosis Research Society- 22; SF- 36: Short Form- 36.

Test-retest reliability of the SJ- 27 for the questions are presented in Table 2. Test- retest reliability for the SJ- 27 total score was identified as excellent (ICC = 0.99, 95% CI: 0.98–0.99). The SJ- 27 has very good internal consistency with the Cronbach alpha value 0.991 [95% CI: 0.984–0.993]. Test-retest reliability and internal consistency results of SJ- 27 domains are presented in Table 3.

Correlation between the Turkish SJ- 27, SRS-22 and SF- 36 are presented in Table 4. The SJ-27 was very good or good correlated to all domains of SRS- 22 (except satisfaction domain) and SF- 36 (except emotional well-being, social functioning and general health). The SJ- 27 demonstrated very good construct validity with the SRS- 22 total (r = –0.61; p < 0.001). The relationship between the similar domains of the SJ- 27 and SRS- 22 questionnaire varied between adequate and very good (r = –0.37 and –0.61). The similar domains of the SJ- 27 and SF- 36 questionnaire was correlated also in the study. Overall, the Turkish SJ- 27 questionnaire showed good validity.

4. Discussion

The study aimed to validate the Turkish version of the SJ- 27 in Turkish population with AIS. The results of the study show that Turkish SJ- 27 is a reliable and valid questionnaire for evaluating HRQOL of patients with AIS.

The SJ- 27 questionnaire has been developed for individuals with AIS and aims to evaluate the quality of life. The developers have reported that the SJ- 27 questionnaire covers a wide range of health-related issues, from pain to psychosocial problems. In addition, their study demonstrates that the SJ- 27 questionnaire is a reliable and valid for female patients with AIS in Japan. The original version of the SJ- 27 had an excellent internal consistency (Cronbach's alpha coefficient, 0.914) and a strong correlation with the SRS- 22 (Spearman's correlation efficient, 0.692) [12]. Our results demonstrated that the SJ- 27 has an excellent test-retest reliability (ICC: 0.99) and is internally consistent with a high Cronbach alpha value of 0.991. The construct validity test also confirmed significant correlations between SJ- 27 total score and SRS domains (except satisfaction domain) as well as SF- 36 domains (except emotional well-being, social functioning and general health). To the best of our knowledge, the SJ- 27 has not been translated into other languages and firstly cross-cultural adaptation was made to Turkish. Therefore, the Turkish SJ- 27 demonstrated satisfactory reliability and validity to assess scoliosis-related quality of life in Turkish AIS population in line with original version.

In the present study, the mean SJ- 27 score was higher than Doi et al.'s study [12]. This difference might be due to cultural differences and curve magnitude variability. Furthermore, in our study population, curve magnitude was relatively lower than original study. The severity of the scoliosis, the skeletal maturation level, treatment history and type, and treatment duration of the patients could be possible factors that may affect these results [19]. However, the effect of these factors was not evaluated in this study. The intraclass correlation was also excellent for test-retest reliability for 27- question and total score. Additionally, there was a very slight difference in the total score of the Turkish SJ- 27 which confirmed the reproducibility of the scale. In terms of internal consistency, our value of Cronbach alpha of the SJ- 27 was quite satisfactory, as represented by the value of 0.99 for the total score and 0.97–0.98 for domains of the questionnaire. Internal consistency of our study was a little higher than the original study [12].

The SJ- 27 demonstrated very good construct validity with the SRS- 22. These finding were slightly lower than reported by original versions [12]. Doi et al. study, correlation coefficient was 0.69, while correlation coefficient of the study was 0.61. The relationship

Table 2
Test-retest reliability of the Turkish SJ-27 for the questions.

Turkish SJ- 27	Test Mean ± SD	Re-test Mean ± SD	Test-Retest Reliability ICC [%95 CI]
Question 1	0.8 ± 1.1	0.9 ± 1.1	0.97 [0.96–0.98]
Question 2	1.2 ± 1.0	1.5 ± 1.1	0.94 [0.88–0.96]
Question 3	1.3 ± 1.0	1.4 ± 1.0	0.91 [0.88–0.94]
Question 4	0.8 ± 0.9	0.9 ± 0.9	0.92 [0.89–0.94]
Question 5	0.4 ± 0.9	0.5 ± 0.8	0.84 [0.78–0.88]
Question 6	0.5 ± 1.0	0.5 ± 0.9	0.96 [0.94–0.97]
Question 7	0.5 ± 1.1	0.6 ± 1.0	0.92 [0.89–0.94]
Question 8	1.2 ± 1.2	1.3 ± 1.2	0.95 [0.93–0.96]
Question 9	1.4 ± 1.1	1.5 ± 1.2	0.96 [0.95–0.97]
Question 10	1.4 ± 1.1	1.5 ± 1.2	0.95 [0.93–0.96]
Question 11	1.8 ± 1.3	1.9 ± 1.2	0.95 [0.94–0.97]
Question 12	1.8 ± 1.4	2.2 ± 1.3	0.90 [0.82–0.93]
Question 13	0.5 ± 1.1	0.7 ± 1.1	0.89 [0.85–0.90]
Question 14	0.8 ± 1.0	0.8 ± 1.0	0.93 [0.90–0.95]
Question 15	1.0 ± 1.2	0.8 ± 1.1	0.87 [0.82–0.91]
Question 16	1.3 ± 1.3	1.3 ± 1.3	0.96 [0.94–0.97]
Question 17	2.0 ± 1.2	1.9 ± 1.1	0.92 [0.89–0.94]
Question 18	2.6 ± 1.2	2.4 ± 1.1	0.96 [0.94–0.97]
Question 19	0.8 ± 1.3	0.9 ± 1.3	0.95 [0.92–0.96]
Question 20	0.9 ± 1.2	1.1 ± 1.1	0.88 [0.83–0.92]
Question 21	3.2 ± 1.2	3.0 ± 1.2	0.88 [0.83–0.91]
Question 22	1.0 ± 1.2	1.2 ± 1.3	0.89 [0.84–0.92]
Question 23	1.2 ± 1.2	1.0 ± 1.2	0.96 [0.94–0.97]
Question 24	0.8 ± 1.2	0.8 ± 1.1	0.95 [0.93–0.96]
Question 25	1.4 ± 1.3	1.3 ± 1.2	0.96 [0.95–0.97]
Question 26	1.2 ± 1.4	1.0 ± 1.2	0.95 [0.93–0.96]
Question 27	1.9 ± 1.4	2.0 ± 1.3	0.95 [0.93–0.96]

SJ- 27: Turkish Scoliosis Japanese Questionnaire- 27, **ICC:** Intraclass Correlation Co-efficient, **CI:** Confidential Interval, **SD:** Standard Deviation.

Table 3
Test–retest reliability and internal consistency results of Turkish SJ- 27.

SJ- 27	ICC [%95 CI]	Cronbach alpha
Pain	0.97 [0.95–0.98]	0.975
Discomfort	0.98 [0.97–0.98]	0.984
Participation	0.96 [0.95–0.97]	0.969
Appearance	0.97 [0.95–0.98]	0.973
Cognition	0.97 [0.95–0.97]	0.970
Total	0.99 [0.98–0.99]	0.991

SJ- 27: Turkish Scoliosis Japanese Questionnaire- 27, **ICC:** Intraclass Correlation Co-efficient, **CI:** Confidential Interval.

between the SJ-27 and the SRS- 22 with regard to similar domains were adequate to very good. The correlations of the Turkish SJ- 27 domains of pain, cognition and appearance showed higher values. The pain domains of the SJ- 27 and pain parameter of SF- 36 was correlated also in the study. In addition, correlations between the cognition domains of the SJ- 27 and role limitation of emotional problems of SF- 36 was found in this study. However, Doi et al. only used the SRS-22 questionnaire in their study. Hence, this result may be attributed to the different contents of SF- 36 domains.

The main difference of our study from the original study was to evaluate not only female but also male patients with AIS. In the Turkish version of the SJ- 27, Question-6 and Question- 13 are

Table 4
Correlation between the Turkish SJ- 27 and SRS- 22, SF- 36.

	Correlation with Turkish SJ- 27											
	Pain		Discomfort		Participation		Appearance		Cognition		Total	
	r	p value	r	p value	r	p value	r	p value	r	p value	r	p value
SRS- 22												
Pain	-0.52	< 0.001	-0.40	<0.001	-0.40	<0.001	-0.49	<0.001	-0.46	<0.001	-0.56	<0.001
Activity	-0.50	<0.001	-0.42	<0.001	-0.37	< 0.001	-0.51	<0.001	-0.44	<0.001	-0.55	<0.001
Image	-0.41	<0.001	-0.30	<0.001	-0.33	<0.001	-0.49	< 0.001	-0.40	<0.001	-0.48	<0.001
Mental	-0.35	<0.001	-0.25	0.003	-0.25	0.002	-0.43	<0.001	-0.41	< 0.001	-0.42	<0.001
Satisfaction	0.04	0.616	0.02	0.766	-0.14	0.081	-0.02	0.774	-0.04	0.595	-0.03	0.698
Total	-0.54	<0.001	-0.42	<0.001	-0.44	<0.001	-0.58	<0.001	-0.53	<0.001	-0.61	< 0.001
SF- 36												
Physical functioning	-0.20	0.018	-0.26	0.002	-0.12	0.130	-0.26	0.002	-0.18	0.030	-0.26	0.002
Rol. Lim.- Phys. health	-0.19	0.022	-0.27	0.001	-0.15	0.072	-0.34	<0.001	-0.27	0.001	-0.31	<0.001
Rol lim.-Em. problems	-0.22	0.008	-0.24	0.004	-0.13	0.115	-0.35	<0.001	-0.28	0.001	-0.31	<0.001
Energy/fatigue	-0.17	0.036	-0.13	0.11	-0.03	0.709	-0.23	0.006	-0.23	0.005	-0.20	0.015
Emotional well being	-0.20	0.014	-0.09	0.285	0.09	0.265	-0.22	0.007	-0.20	0.015	-0.16	0.054
Social functioning	-0.14	0.083	-0.12	0.143	0.03	0.703	-0.18	0.026	-0.11	0.176	-0.14	0.097
Pain	-0.34	< 0.001	-0.18	0.033	-0.06	0.433	-0.26	0.002	-0.20	0.014	-0.26	0.002
General health	-0.11	0.187	-0.01	0.863	-0.08	0.331	-0.23	0.005	-0.20	0.018	-0.16	0.059

SJ- 27: Turkish Scoliosis Japanese Questionnaire- 27, **SRS- 22:** Scoliosis Research Society- 22, **SF- 36:** Short Form- 36. Bold marks represent similar domains of each scale.

adapted to answer male patients with AIS. In order for the questionnaire to be used in both female and male with AIS, Question- 6 and Question- 13 have been adapted as follows (Q6: To what extent are you concerned about the waistline of a skirt or pants?; Q13: Do you feel embarrassed to bathe with your mother/father or sisters/brothers because of the curve of your back?) Therefore, one of the strengths of this study, we have found that SJ- 27 can be used in Turkish population with scoliosis, regardless of whether it is a girl or boy. Another strength of this study is that it provides an alternative questionnaire opportunity to measure the quality of life in scoliosis. Until now, Turkish adaptation of SRS- 22 was commonly used tool to assess HRQOL in individuals with idiopathic scoliosis. Apart from SRS- 22, it also enables the use of SJ- 27 in the Turkish scoliosis population. However, this study has a few limitations. The sensitivity of the SJ- 27 to change could have been evaluated. Relatively few male patients with AIS were included in present study, and quality of life differences in female and male patients could not be compared. Future research shall evaluate the responsiveness of the Turkish version of the SJ- 27 to examine its ability to detect important changes in quality of life over time or with treatment.

5. Conclusion

The Turkish version of SJ- 27 showed high test-retest reliability, very good internal consistency with satisfactory validation. We suggest the SJ- 27 is a reliable and valid outcome to assess scoliosis related quality of life in Turkish AIS population.

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The IRB approval

The study was approved by the Non- Interventional Clinical Research Ethics Committee (Registration number: GO 19/204, the start date of the study: 01/24/2019 and end date of the study: 02/13/2020).

Declaration of competing interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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