

Validity and reliability of the Arabic version of the Stress Numerical Rating Scale-11 (Stress NRS-11)

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Research Article

Keywords: Stress Numerical Rating Scale, Arabic SNRS-11, Arabic, Psychometric properties, Validation

Posted Date: March 22nd, 2024

DOI: <https://doi.org/10.21203/rs.3.rs-4141862/v1>

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Additional Declarations: The authors declare no competing interests.

Abstract

Background: Meta-analytic results have revealed a significant influence of stress on a wide array of psychological and behavioral markers, underscoring its considerable clinical importance. Providing a simple and cost-effective tool assessing stress for the Arabic-speaking population, predominantly residing in low- and middle-income nations, where research can be arduous, would be immensely beneficial. Therefore, our aim was to examine the psychometric properties of an Arabic version of the Stress Numerical Rating Scale-11 (Arabic SNRS-11), including its factor structure, reliability, and construct validity.

Methods: 763 participants were recruited during November 2023. An anonymous self-administered Google Forms link was distributed via social media networks. To explore the factor structure of the Arabic SNRS-11, we utilized the FACTOR software. Initially, an exploratory factor analysis (EFA) was performed, employing principal component analysis on the items from the Perceived Stress Scale (PSS). Subsequently, the analysis was repeated after integrating the Arabic SNRS-11.

Results: The results of the EFA revealed two factors, which explained 66.43% of the common variance. When adding the SNRS-11, Bartlett's test of sphericity, $\chi^2(55) = 4127.1, p < .001$, and KMO (.88) remained adequate. The two-factor solution obtained explained 63.28% of the variance. The same structure was obtained in both males and females separately. McDonald's ω and Cronbach's α were very good for all models. Both PSS and Arabic SNRS-11 scores correlated significantly and positively with each other, as well as with higher depression, anxiety and stress scores. Finally, no significant difference was found between males and females in terms of PSS and Arabic SNRS-11 scores.

Conclusion: The findings indicate that the Arabic SNRS-11 is a cost-effective, valid, and reliable tool for assessing stress. Therefore, we strongly recommend its adoption in future research involving Arabic-speaking adolescents in clinical and research contexts within Arab regions, especially when researchers face limitations in terms of time or resources.

1. Background

Stress is intricately intertwined with both physical and psychological dimensions of health and overall well-being, underscoring its significance as a vital subject of examination in the field of psychiatry [1]. Perceived stress is defined as 'the feelings or thoughts of an individual about how much they are under stress at a given point in time' [2]. The stress phenomenon encompasses a combination of physiological [3, 4], psychological [5], and social [6] reactions occurring when unpredictable environmental changes disrupt an individual's equilibrium or homeostasis, subsequently eliciting a stress response [7]. Thus, the progression of stress responses is influenced by factors such as environmental predictability and physiological limits [8].

Strong evidence suggests that the cumulative effects of stress have been linked to various mental health issues, including depression [10–12], anxiety and suicidal ideation [13], poor sleep quality [14],

challenging living conditions, health problems [15], and difficulties in interpersonal relationships [16]. Additionally, stress was found to be linked to socio-demographic and psychosocial factors in both males and females, including lower household income, lower educational attainment, and living alone [19]. Hence, evaluating stress holds great significance for both research and clinical objectives.

Measures of stress

While concise instruments like the Subjective Units of Distress Scale [20] have been employed to gauge momentary emotions and internal states (including anxiety, anger, agitation, stress, or other distressing feelings), there hasn't been a scale specifically designed for measuring momentary stress. Littman, White, Satia, Bowen, and Kristal [21] highlight that stress assessment has predominantly concentrated on quantifying stressors or investigating psychological reactions to stressors.

Subjective stress scales validated for use with pediatric populations include the Children's Hassles Scale (comprising 43 questions) [22], the Perceived Stress Scale (with 14 questions; a shorter version has 10 questions) [6], and the Children's Hassles and Uplifts Scale (consisting of 25 questions) [23]. While these tools are valuable, their completion can be time-consuming, ranging from 10 to 43 questions [24]. With the exception of The Children's Hassles Scale, most of these scales primarily assess past stress levels to estimate current stress. As an example, the Perceived Stress Scale (PSS), validated in different languages [25–28] including Arabic [29–32], assesses an individual's overall life stressors over the preceding month. The respondent's evaluation of the frequency with which they have experienced nervousness and stress in the past month may be susceptible to retrospective bias, influenced by their recall of past events and their current emotional state.

Overall, the currently employed subjective stress scales have drawbacks, such as their length, mode of administration, potential retrospective bias [33, 34], and the challenge of evaluating past stress to estimate present stress [35]. Therefore, creating a concise and easily administered tool for assessing current stress response levels, adaptable to various modes of administration, and incorporating a brief screening approach, would be valuable for both clinical and research purposes. In pursuit of this objective, the Stress Numerical Rating Scale-11 (SNRS-11) has been developed [24].

The Stress Numerical Rating Scale-11 (SNRS-11)

The Stress Numerical Rating Scale (SNRS-11) captures both momentary (state) and day-to-day stress, as indicated by Karvounides et al. (2016) [24]. Modeled closely after the pain Numerical Rating Scale (NRS) by Von Baeyer [36], the SNRS-11 is a single-item scale with a range of 0 to 10 and similar endpoint anchors: 0 = "No stress" and 10 = "Highest stress possible." For momentary stress, respondents provide their level of stress factually in the moment, while for day-to-day stress, they rate stress experienced over the past week. Emphasizing stress intensity as one dimension of the multidimensional stress construct, the SNRS-11 mirrors the NRS-11's focus on assessing and measuring pain intensity as one dimension of pain.

The Stress Numerical Rating Scale-11 (SNRS-11) is a straightforward, one-item stress scale with demonstrated preliminary validation in samples of adolescents and emerging adults [24]. Additionally, the 0 to 10 scale is readily comprehensible and accomplished by children, as indicated by Crandall et al. [37]. In particular, the Numerical Rating Scale (NRS) is validated for use in children as young as 8 years old, and potentially even as young as 6 years, depending on the context [38]. Moreover, employing a numerical scale with straightforward anchors helps prevent misunderstandings and reduces the likelihood of a broad range of interpretations [37].

The present study

Stress is a universal aspect of everyday life, but its manifestations vary significantly across cultures [39] due to differences in physical, climatic, ecological, social, and political factors. Thereby, Western cultures differ from Eastern cultures in terms of the four theoretical dimensions [40]: individualism vs. collectivism, cognitivism vs. emotionalism, free will vs. determinism, and materialism vs. spiritualism. Research by Hashimoto et al. (2012) has shown that collectivist societies often report higher levels of perceived stress, particularly related to interpersonal relationships [41]. This heightened sensitivity in interdependently oriented cultures, where social harmony is highly valued, can lead to greater perceived stress. Moreover, individualistic societies tend to prioritize acknowledging and expressing their psychological states and emotions [42]. In contrast, collectivist individuals often believe that psychological states and bodily sensations are intertwined and place a higher value on emotional reserve for the sake of social harmony [42].

In the past decade, numerous Arab nations have experienced wars, conflicts, and significant social and geopolitical transformations, all of which have had detrimental effects on the mental well-being of their populations [43, 44]. A recent study involving secondary school students in Saudi Arabia indicated a prevalence of anxiety at 35.2%, followed by depression at 30.8%, and stress at 14.7% [45]. This underscores the significance of addressing social stressors like bullying and physical assault and advocating for a secure and supportive school environment to prevent mental health disorders in this population. Another study conducted among adolescents in the United Arab Emirates [46], utilizing the PSS-14, found that the overall perceived stress level was high in 20% of respondents and moderate in 76%. This emphasizes the importance of early identification of adolescents experiencing severe academic stress. Data collected from Lebanon underscores the high levels of stress experienced by the population, all within a country grappling with limited resources [47].

In order to facilitate and encourage research both within and across Arab nations on the stress topic, we embarked on an investigation into the psychometric properties of an Arabic translation of the SNRS-11, denoted as Arabic SNRS-11. This investigation encompassed an exploration of its factor structure, reliability, and construct validity. Furthermore, we analyzed the connections between Arabic SNRS-11 scores and indicators such as psychological distress, and perceived stress. The aim of introducing this straightforward and cost-effective tool for assessing stress to the Arabic-speaking community, which largely resides in low- and middle-income countries, where research endeavors can be particularly

challenging, holds substantial value. Hence, having a straightforward, rapid, and precise assessment method could offer numerous advantages, such as streamlining the creation of tailored interventions. [37].

2. Methods

Procedures

A total of 763 Lebanese adults from all districts/governorates of Lebanon participated in this cross-sectional study in November 2023. Using a snowball sampling approach, a survey was created on Google Forms and circulated across messaging applications and social media networks (WhatsApp, Instagram, Messenger). Before proceeding with the questionnaire, participants were informed of the purpose of the study, assured of the anonymity of their participation and provided with a virtual informed consent form via 'Google Forms'. The latter had to be "signed", after reading, by clicking the box *"Yes, I acknowledge having read the above-mentioned information and I agree to participate in this study voluntarily and without any pressure"* to which the answer is required in order to continue with the self-administration. Internet protocol (IP) addresses were checked to ensure that no one responded to the poll more than once. After participants gave digital informed consent, the aforementioned items were given in a pre-randomized order to account for order effects. Participants had the right to accept or refuse to respond, and no financial compensation was provided in exchange for their submission.

Minimal Sample Size Calculation

A minimum of 100–110 participants was deemed necessary based on 10 participants per item's scale [48].

Measures

The Arabic questionnaire assessed the sociodemographic characteristics of the included participants (sex, marital status and education level), as well as the following scales:

The Stress Numerical Rating Scale-11 (SNRS-11). To gauge momentary stress, participants answered the question, *"On a scale of 0 to 10, with 0 being no stress and 10 being worst stress possible, what number best describes your level of stress right now?"* [24]. Below the question, the 11 numerical options were evenly spaced on the page, with reference points labeled beneath the "0" and "10." Participants indicated their stress level by circling the corresponding number. The scores were then classified into categories: no stress (0), mild stress (1–3), moderate stress (4–7), and severe stress (8–10) [49].

The Cohen Perceived Stress Scale-10 (PSS-10). The PSS-10 is a self-report measure comprising 10 items designed to assess global perceived stress [6] (e.g. *In the last month, how often have you been upset because of something that happened unexpectedly?*). To derive a total score ranging from 0 to 40, the four positively worded items are reverse-scored, and the sum of all scale items is calculated. Higher total

scores on this scale are indicative of elevated levels of perceived stress. The Arabic validated version of the PSS-10 was used [31] ($\omega = .81 / \alpha = .83$).

The Depression Anxiety Stress Scale (DASS-8). The DASS-8, a shortened version of the DASS-21, consists of eight items divided into three subscales: depression (3 items; e.g. *I was unable to become enthusiastic about anything*), anxiety (3 items; e.g. *I felt scared without any good reason*), and stress (2 items; e.g. *I felt that I was using a lot of nervous energy*) [50]. Responses to the items are scored on a 4-point scale, ranging from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time). The DASS-8 has a score range of 0 to 24, whereas the subscale scores fall into the ranges of 0 to 9, 0 to 9, and 0 to 6, respectively. Higher scores equate to a higher level of symptom affirmation. The reliability coefficients were as follows: depression ($\omega = .75 / \alpha = .75$), anxiety ($\omega = .77 / \alpha = .77$) and stress ($\alpha = .58$).

Translation Procedure

Prior to implementation in the current study, the SNRS-11 scale underwent translation and adaptation into the Arabic language and context. The translation process involved rendering the scale into literary Arabic (Modern Standard Arabic), the official language across Arab nations and utilized for cross-group communication. The objective was to achieve semantic equivalence between the original and Arabic versions in accordance with international norms and recommendations [51]. This was accomplished through a forward and backward translation method.

A Lebanese translator, not affiliated with the study, translated the English version into Arabic. Subsequently, a Lebanese psychologist proficient in English translated the Arabic version back into English. The translation team ensured a balanced approach, addressing any specific or literal translations. A committee of experts, consisting of two psychiatrists, one psychologist, the research team, and the two translators, compared the initial and translated English versions to identify and rectify any inconsistencies, thereby ensuring translation accuracy [52].

To adapt the measure to the specific context, the translation team scrutinized for potential misunderstandings in item wording and evaluated the ease of item interpretation. This process aimed to guarantee conceptual equivalence between the original and Arabic scales in both contexts [53]. Following the translation and adaptation, a pilot study involving 20 participants was conducted to confirm comprehension of all questions. No changes were made after the pilot study, indicating the clarity and appropriateness of the translated scale.

Analytic strategy

There were no missing responses in the dataset. To examine the factor structure of the Arabic Stress NRS-11, we used an exploratory factor analysis, using a principal component analysis using the FACTOR software [54]. We verified all requirements related to item-communality [55], average item correlations, and item-total correlations [56]. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (which should ideally be $\geq .80$) and Bartlett's test of sphericity (which should be significant) ensured the

adequacy of our sample [57]. The Measure of Sampling Adequacy (MSA) at the item level was also verified, with values below 0.5 leading to the elimination of the item [58]. The procedure followed for determining the number of dimensions was the Parallel Analysis (PA) [59], using the polychoric correlation matrix in view of the ordinal nature of the data. Item retention was based on the recommendation that items with “fair” loadings and above (i.e., $\geq .33$) [60].

Composite reliability in both subsamples was assessed using McDonald’s ω and Cronbach’s α coefficients, with values greater than .70 reflecting adequate composite reliability [61]. The total PSS and Arabic Stress NIS-11 scores followed a normal distribution, with skewness and kurtosis values varying between -1 and $+1$ [62]. The Student t test was used to compare the scores between sex groups. To assess convergent and concurrent validity, the Pearson test was used to correlate the scores with the DASS subscales scores. Values $\leq .10$ were considered weak, $\sim .30$ were considered moderate, and $\sim .50$ were considered strong correlations [63].

3. Results

Descriptive statistics

Seven hundred sixty-three Lebanese participants completed the survey, with a mean age of 16.08 years (SD = 1.74), with 62.4% females. Table 1 presents the descriptive statistics of the used scales, which were all considered as normally distributed. The Arabic SNRS-11 had a mean of 4.79 (SD = 2.47, range: 0–10), a median of 5.00, a mode of 5, with the majority of the participants scoring 5 (21.9%) and 4 (14.9%) respectively.

Table 1
Descriptive statistics of all scores.

	Mean	SD	Min	Max	Skewness	Kurtosis
Arabic Stress NRS-11	4.86	2.54	0	10	.096	-.657
PSS	27.48	3.20	10	50	-.125	1.348
Depression	3.66	2.16	0	9	.112	-.411
Anxiety	3.61	2.17	0	9	.168	-.405
Stress	2.65	1.49	0	6	.181	-.405

Exploratory Factor Analysis

Factor analysis on the total sample. The relevance of the items was analyzed using the MSA index, which indicated that all items measured the same domain as the rest of the questionnaire, with a value greater than 0.50 for all items. The Bartlett’s test of sphericity, $\chi^2(45) = 3874, p < .001$, and KMO (.874) indicated that the PSS items had adequate common variance for factor analysis. The results of the EFA revealed two factors, which explained 66.43% of the common variance. When adding the SNRS-11, Bartlett’s test

of sphericity, $\chi^2(55) = 4127.1$, $p < .001$, and KMO (.88) remained adequate. The two-factor solution obtained explained 63.28% of the variance. The same structure was obtained in both males and females separately (Table 2). McDonald's ω and Cronbach's α were very good for all models.

Table 2
Rotated factor loads obtained from the Exploratory Factor Analysis (EFA)

EFA 1: conducted on the total sample.				
	Model 1: EFA of PSS items alone		Model 2: EFA of PSS items + SISS	
	Factor 1	Factor 2	Factor 1	Factor 2
PSS 1	.72	.16	.17	.73
PSS 2	.83	.07	.09	.83
PSS 3	.78	.09	.10	.79
PSS 4	.22	.71	.71	.20
PSS 5	-.001	.78	.78	-.02
PSS 6	.69	.19	.21	.68
PSS 7	.15	.78	.77	.13
PSS 8	.13	.75	.76	.10
PSS 9	.71	.13	.15	.71
PSS 10	.76	.09	.12	.73
Arabic SNRS-11	-	-	-.11	.52
McDonald's ω	.87	.82	.82	.80
Cronbach's α	.86	.82	.82	.79
EFA 2: conducted on males only.				
PSS 1	.77	.14	.76	.16
PSS 2	.80	.10	.80	.13
PSS 3	.76	.12	.77	.14
PSS 4	.22	.74	.20	.75
PSS 5	.03	.81	.001	.82
PSS 6	.74	.19	.73	.20
PSS 7	.20	.82	.17	.82
PSS 8	.16	.77	.13	.77

Numbers in bold indicate the highest loading factor; PSS = Perceived Stress Scale; Arabic SNRS-11 = Arabic Stress Numerical Rating Scale-11

EFA 1: conducted on the total sample.				
	Model 1: EFA of PSS items alone		Model 2: EFA of PSS items + SISS	
	Factor 1	Factor 2	Factor 1	Factor 2
PSS 9	.70	.22	.70	.24
PSS 10	.76	.10	.75	.13
SISS	-	-	.45	-.09
McDonald's ω	.87	.85	.85	.77
Cronbach's α	.87	.85	.85	.77
EFA 3: conducted on females only.				
PSS 1	.69	.19	.71	.20
PSS 2	.85	.07	.84	.09
PSS 3	.79	.08	.80	.10
PSS 4	.22	.68	.20	.69
PSS 5	-.004	.77	-.02	.76
PSS 6	.67	.20	.65	.22
PSS 7	.14	.75	.12	.74
PSS 8	.13	.74	.10	.76
PSS 9	.71	.09	.71	.11
PSS 10	.76	.09	.73	.12
Arabic SNRS-11	-	-	.58	-.12
McDonald's ω	.86	.80	.80	.81
Cronbach's α	.86	.80	.80	.80
Numbers in bold indicate the highest loading factor; PSS = Perceived Stress Scale; Arabic SNRS-11 = Arabic Stress Numerical Rating Scale-11				

Convergent and concurrent validity

Both PSS and Arabic SNRS-11 scores correlated significantly and positively with each other, as well as with higher depression, anxiety and stress scores (Table 3). Finally, no significant difference was found between males and females in terms of PSS and Arabic Stress NRS-11 scores (Table 4).

Table 3
Correlation of the Perceived Stress Scale score and the Arabic SNRS-11 with other continuous variables.

	1	2	3	4	5
1. Arabic SNRS-11	1				
2. Perceived Stress	.31***	1			
3. Depression	.34***	.34***	1		
4. Anxiety	.33***	.34***	.70***	1	
5. Stress	.39***	.43***	.68***	.64***	1
*p < .05; ***p < .001					

Table 4
Bivariate analysis of the Perceived Stress Scale (PSS) and the Arabic SNRS-11 with categorical variables.

	PSS				A-SISS			
	Mean ± SD	<i>t</i>	<i>df</i>	<i>p</i>	Mean ± SD	<i>t</i>	<i>df</i>	<i>p</i>
Sex		-1.40	791	.163		-1.53	791	.125
Male	27.08 ± 6.43				4.68 ± 2.56			
Female	27.72 ± 6.06				4.97 ± 2.52			

Numbers in bold indicate significant *p* values.

4. Discussion

In this study, our objective was to translate and validate the Arabic version of the SNRS-11. EFA affirmed good congruence of factor structure across sex. The Arabic SNRS-11 exhibited acceptable composite reliability coefficients. Comparisons between the PSS and Arabic SNRS-11 indicated similar relationships with the variables under investigation, including anxiety, depression, and stress. These findings established a sufficient level of construct validity for both measures.

We found a mean Arabic SNRS-11 score of 4.79 ± 2.47 . EFA yielded a two-factor structure of the Arabic SNRS-11, in opposite to the one-dimensional measure obtained in the original validation [24] and another validation in both inpatient and outpatient settings [35]. Although there are advantages to the one-dimensional measure as discussed, it does reduce the ability to measure multiple dimensions of stress [37]. Additionally, we found positive correlations between the PSS and Arabic SNRS-11 scores, suggesting that the single-item scale is informative and relevant to assess the stress construct.

Both PSS and Arabic SNRS-11 scores correlated significantly and positively with higher depression, anxiety and stress scores, in line with existing research that highlights a relationship between the stress response to a stressor (termed perceived stress) and psychological distress, defined as a comprehensive concept encompassing a wide spectrum of symptoms, ranging from everyday feelings of vulnerability and fear to severe mental conditions like depression, anxiety, and adjustment disorder [64, 65]. For instance, a study involving Chinese physicians [66] demonstrated that perceived stress played a substantial role in explaining the variation in psychological distress (43.1%), self-affirmation (23.2%), depression (23.6%), and anxiety (23%). Furthermore, another study suggested that the total distress score, along with its emotional and social distress subscales, exhibited positive correlations with anxiety and depression, hinting at a potential overlap between these two constructs [67]. Hence, it is advisable to incorporate stress reduction strategies into interventions aimed at preventing and treating psychological distress.

In the sex comparison of stress scores, no statistically significant differences were observed between males and females in terms of PSS and Arabic SNRS-11 scores. Multiple studies showed that females generally reported lower well-being compared to men [68] and suggested that males and females have different responses to stress [69–71], and this sex disparity can be attributed to a combination of biological and social determinants. These determinants encompass sex stereotypes, cultural background, inequities, social segregation, and issues related to autonomy [72].

More precisely, females not only tend to experience a greater number of stressful life events [71] but also employ different coping strategies; females often lean towards a "tend-and-befriend" response to stressors, while males are more inclined to exhibit a "fight or flight" reaction [73]. This aligns with studies demonstrating that females often engage in emotion-focused coping or passive coping strategies, while men tend to prefer active coping strategies [74]. It's important to note that the choice of coping strategy can vary depending on the specific stressor [75], and available response options [76]. On the other hand, these sex differences appear to be influenced by genetic factors present on sex chromosomes and the production of gonadal hormones [71].

Study Limitations

When discussing the limitations of the current study, it's crucial to begin by highlighting that the single-item measures have faced criticism for their potentially lower and uncertain reliability. This arises from the fact that estimating measurement error may not conform to the prescribed model, which typically relies on intercorrelations among multiple items to determine reliability (i.e., the internal consistency approach) [77]. Consequently, when only a single item is employed, the measure may not be amenable to internal consistency assessment procedures [77]. To overcome this limitation, it is advisable to explore alternative methods, such as test-retest reliability assessments, as recommended [77]. These approaches should be taken into account in future research endeavors.

Additional limitations need to be considered. This study is cross-sectional in nature, which implies that causation cannot be directly inferred from the findings. Furthermore, the symptoms were self-reported

and not evaluated by healthcare professionals, making them inherently subjective. It's also important to note that the results of this study may not be easily generalized to the entire population due to the sample composition, which predominantly consisted of females (62.4%), recruited through the snowball technique.

Although the abovementioned limitations, this study indicates potential promise for the Arabic SNRS-11. The availability of a practical and clinically relevant self-report measure, which facilitates the collection and categorization of momentary or day-to-day stress in an uncomplicated and cost-free manner, will enable systematic assessment and tracking of stress over time.

5. Conclusion

The objective of the current study was to give evidence of the Arabic SNRRS-11 reliability and validity. This was accomplished by looking at the Arabic SNRS-11 factor structure's consistency across gender, composite reliability, and construct validity. Subsequently, it is recommended to use this single item to assess momentary or day-to-day stress among Arabic-speaking adolescents in Arab clinical and research settings. To evaluate the practical effectiveness of the Arabic SNRS-11 and to further enhance the data on its construct validity, future studies should assess the measure in diverse contexts and among specific populations.

Declarations

Ethics Approval and Consent to Participate: Ethics approval for this study was obtained from the ethics committee of the School of Pharmacy at the Lebanese International University. Written informed consent was obtained from all subjects; the online submission of the soft copy was considered equivalent to receiving a written informed consent. All methods were performed in accordance with the relevant guidelines and regulations.

Consent for publication: Not applicable.

Availability of data and materials: All data generated or analyzed during this study are not publicly available due the restrictions from the ethics committee, but are available upon a reasonable request from the corresponding author.

Competing interests: The authors have nothing to disclose.

Funding: None.

Author contributions: SO, FFR and SH designed the study; SO drafted the manuscript; SH carried out the analysis and interpreted the results; SEK, FS and MD collected the data. RH and DM reviewed the paper for intellectual content; all authors reviewed the final manuscript and gave their consent.

Acknowledgements: The authors would like to thank all participants.

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