Research Article

Translation, Cultural Adaptation, and Validation of the Persian Lysholm Knee Scale in Iran

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Running title: Persian Lysholm Knee Scale: Translation & Validation

Abstract

Background: Valid and culturally adapted patient-reported tools are essential for accurate clinical assessment of knee injury outcomes. This study aimed to translate the English Lysholm Knee Scoring Scale (LKSS) into Persian and comprehensively validate it.

Methods: This methodological study (test development) employed a cross-sectional design. The LKSS was translated using Guillemin's standard method. Validity and reliability were assessed in a sample of 182 patients with knee injuries. We evaluated content validity (Content Validity Ratio

(CVR) and Content Validity Index (CVI)), face validity (impact score), convergent validity (correlation with the International Knee Documentation Committee (IKDC) form), construct validity (Exploratory Factor Analysis (EFA)), and reliability, including internal consistency (Cronbach's alpha), test-retest reliability (Intraclass Correlation Coefficient (ICC)), and Standard Error of Measurement (SEM).
Results: All items demonstrated acceptable content validity (CVR >0.79 and CVI >0.62). All face validity impact scores were above the 1.5 threshold. Convergent validity was excellent, with a very high correlation between the LKSS and IKDC ($r=0.804$, $p<0.001$). The EFA supported a one-factor structure (KMO=0.829; Bartlett's test $p<0.001$), explaining 42.39% of the variance. Reliability was outstanding, with an ICC of 0.95, a Cronbach's alpha of 0.894, and an SEM of 5.14.
Conclusion: The Persian LKSS demonstrated high validity and reliability across all measured metrics. These results confirm it is a psychometrically sound and suitable instrument for assessing knee-related function and outcomes in the Iranian population, suitable for both clinical and research applications.
Keywords: Knee injuries; Patient reported outcome measures; Translating; Iran; Questionnaire

Introduction

The knee, as the largest and most complex joint in the body, is highly susceptible to injury during physical activity at all ages, especially among young people and athletes (1, 2). Knee injuries can lead to pain, changes in functional level, or partial loss of sports capacity, and may require surgical treatment and long-term physiotherapy (3). It is necessary to use an appropriate, valid tool to assess the injury status and clinical outcomes of these patients (4). Patient-based scales are more closely related to scores on subjective symptom and functional scales. Moreover, several studies have shown that the validity of these patient-reported outcome measures is often better than that of "objective" clinical measures (4, 5). Specific knee joint scales, focusing on clinical signs and subjective symptoms, are designed to assess the impact of injury on knee function and quality of life, thereby providing a more accurate picture of knee condition and treatment effects (4, 5).

The Lysholm Knee Scoring Scale (LKSS) is a well-known and reliable patient-reported joint-specific scale that quantifies subjective symptoms in patients with knee injuries (4, 5). The LKSS was first introduced in 1982; its modified version was presented in 1985 to evaluate patients with anterior cruciate ligament (ACL) injuries subjectively (6). Although the LKSS was initially developed for ACL injury, it was later validated for evaluating patients with patellofemoral pain syndrome, patellar tendonitis, meniscal injuries, medial patellar plica syndrome, patellar dislocation, various cartilage disorders, knee arthroplasty, and even people with normal knees (4). Compared to other knee scoring scales, the LKSS has several advantages. It has a broader application, is brief, and contains only eight items that patients can complete, and therapists can evaluate in a short time.

Furthermore, it is not disease-specific and can therefore be used to assess various knee problems (5). Because of these advantages, the LKSS has been used by therapists and researchers for the past 4 decades. Over the past years, numerous articles cited in PubMed have reported their outcomes using this score. In addition, its original English version has been translated and validated in many languages, including Chinese, Spanish, Turkish, Greek, Dutch, German, Portuguese, Indonesian, Italian, Thai, Urdu, and Arabic (2, 7-17). Very recently, the Persian version of the Lysholm Knee Scoring Scale was validated in a sample of Iranian patients with anterior cruciate ligament (ACL) injury (18). However, the Lysholm scale is widely used across

various knee pathologies beyond ACL injury, including meniscal injuries, patellofemoral pain, and degenerative joint disease. Therefore, the present study aimed to validate the Persian Lysholm scale in a broader and more heterogeneous patient population with various knee disorders.

Materials and methods

Study design

This was a methodological study (test development) with a cross-sectional design. The Persian version of the LKSS was developed. Participants were recruited from the physiotherapy outpatient centers of the Rehabilitation Faculty at Tabriz University of Medical Sciences, Iran. The data collection process took place in Tabriz from 2022 to 2023.

Participants

The psychometric properties of the Persian LKSS were evaluated in 182 Persian patients (with at least 20 patients per item for each of the 8 LKSS items) who had orthopedic knee problems, such as ACL deficiency or reconstruction, meniscal injuries, patellofemoral joint issues, and degenerative joint disease, diagnosed by orthopedists. The sampling method was convenience sampling. Participants were at least 18 years old and had adequate reading ability. Rheumatoid arthritis, tumors, septic arthritis, neurological and cognitive problems, and a history of other lower extremity or spinal injuries or fractures were considered as exclusion criteria. For participants with bilateral involvement, data collection was conducted based on the knee with greater symptoms. Participants also must not have been receiving treatment for a knee injury at the time of the study. All participants had carefully read and signed the informed consent form. The average time required to complete the questionnaire was recorded.

Procedure

The LKSS is a self-reported joint-specific scale that consists of eight items, including limping, using a cane or crutches, stair climbing, squatting, instability, locking and grasping, pain, and swelling on a score of 0 to 100. Pain and instability have the most weight, each with a maximum of 25 points. Locking with a maximum of 15 points, swelling and stair climbing each with a maximum of 10 points, and limping, using a cane, and squatting each with a maximum of 5 points make up the score. In this scoring system, 95 to 100 points are considered excellent, 84 to 94 points good, 65 to 83 points fair, and less than 65 points poor (4, 5).

Translation

To adapt the LKSS to the Persian language and culture, Guillemin's method was used (19). After obtaining permission from the main developer of the scale, in the forward translation stage, the original version of the scale was translated into Persian by two independent translators with a good command of English and Persian (one with medical expertise and the other without). Then the two versions were reviewed and discussed by an expert team, including the translators, a physiotherapist, an orthopedist, and a linguist, regarding clarity and controversy of the items, and were combined into one. In the backward translation stage, the final version was translated from Persian to English by two English-speaking translators having a good command of Persian who did not have access to the original version of the scale. Again, two translated English versions were reviewed by an expert team, and the synthesized version was prepared. Finally, this final version was sent to the main developer, and his approval was obtained. The Persian version was checked for pilot study, validity, and reliability.

Psychometric Properties

The study process included validity and reliability. In the validity process, content, face, convergent, and construct validity were assessed. Reliability included internal consistency, test-retest reliability, and standard error of measurement. Participants under the supervision of a trained physiotherapist completed the LKSS.

Content Validity

Content validity refers to the degree to which the items in a scale are impartially representative of, and relevant to, the entire field of the scale that it is considered to measure. Content validity was examined both qualitatively and quantitatively. Ten orthopedic, physiotherapy, and rehabilitation specialists were asked to comment on the clarity, simplicity, and relevance of the items. To quantitatively check content validity, the Lawshe method was used, and the content validity ratio (CVR) and the content validity index (CVI) were calculated. To calculate CVR, the experts were asked to evaluate each item on the scale using three options: necessary, useful but not necessary, and not necessary. According to Lawshe's Table, since the expert group included ten people, the acceptable value of the CVR is above 0.62. To calculate CVI, experts were asked to rate each item in the scale on relevance, clarity, simplicity, and fluency using a four-option Likert scale. CVI is calculated by dividing the number of experts giving each item a score of 3 or 4 by the total number of experts. A CVI score of 0.79 and above is considered acceptable (19). To assess the overall content validity of the entire scale, the scale-level content validity index (S-CVI) was calculated using the average method (S-CVI/Ave). Accordingly, the S-CVI/Ave was obtained by summing all item-level CVI scores and dividing by the total number of items (8 items). An S-CVI/Ave of ≥ 0.80 was considered acceptable (20).

Face Validity

The face validity of the scale was evaluated both qualitatively and quantitatively. Qualitatively, the opinions of 20 patients with knee injuries were sought regarding the comprehensibility, clarity, understandability, and acceptability of the items. Quantitatively, face validity was assessed by calculating the item impact score. Participants were asked to rate the relevance and clarity of each item on a five-point Likert scale (1 = not clear/relevant, 5 = very clear/relevant). The impact score for each item was then calculated using the following formula:

Impact Score=Frequency (%) of participants who rated the item 4 or 5×Mean relevance/clarity rating

An impact score above 1.5 was considered acceptable, indicating that the item was perceived as clear and relevant by the target population (20).

Convergent Validity

Convergent validity examines the correlation between a new scale and another similar scale that measures the same concept. It means that different measurements of a construct should have similar results. To assess convergence validity, the correlation between the Persian version of the LKSS and the International Knee Documentation Committee (IKDC) score was examined, and Pearson's Correlation Coefficient was calculated. In interpreting the Pearson correlation coefficient, values between 0.8 and 1.0 indicate a robust correlation, between 0.6 and 0.8 a strong correlation, between 0.4 and 0.6 a moderate correlation, and below 0.4 a weak correlation (21).

Construct Validity

Construct validity refers to the extent to which the instrument effectively measures the intended construct(s). The construct validity of the scale was assessed using an exploratory factor analysis (EFA). At EFA, the goal is to determine the number of factors in the scale items and the factor loadings for each variable. The Kaiser-Meyer-Olkin (KMO) measure is greater than 0.6, and the significant level of Bartlett's test of sphericity ($P < 0.05$) indicates the adequacy of the sampling. Total variance explained, and the scree plot were used to assess the number and loadings of factors (20).

Ceiling and Floor Effects

The ceiling and floor effects were examined by assessing the percentage of patients with the highest and lowest scores, respectively, and by determining whether more than 15% of patients achieved the highest or lowest possible score. When floor or ceiling effects are present, the scale cannot differentiate between patients with the lowest and highest possible scores, leading to limited content validity (20).

Reliability

Cronbach's alpha was used to assess internal consistency. A Cronbach's alpha coefficient above 0.90 is considered excellent, between 0.80 and 0.90 is good, between 0.70 and 0.80 is acceptable, between 0.60 and 0.70 is questionable, between 0.50 and 0.60 is poor, and below 0.50 is unacceptable (22). Stability was assessed using the test-retest method and the Intraclass Correlation Coefficient (ICC) with a two-way random-effects model (ICC(2,1)) for absolute agreement. The ICC ranges from 0 to 1 and reflects the degree of agreement or stability among measurements. An ICC greater than 0.90 indicates excellent reliability, values between 0.75 and 0.90 suggest good reliability, values between 0.50 and 0.75 indicate moderate reliability, and values below 0.50 reflect poor reliability (23). The Standard Error Measurement (SEM) was also calculated with the formula $SEM=SD\times\sqrt{(1-ICC)}$, where ICC is the test-retest reliability, and SD is the standard deviation of the test scores. A larger SEM indicates lower instrument precision. Sixty-two patients with no change in their knee symptoms or condition during the time interval were asked to complete the scale 7 days after the first assessment for the test-retest analysis (20).

Statistical analysis

Descriptive statistics were used to summarize the data, with continuous data presented as mean ± SD or median (minimum, maximum) based on normality, and categorical data summarized as frequencies and percentages. Statistical analysis was performed using SPSS software, version 26 (SPSS Inc., Chicago, IL, USA), and a $P<0.05$ was considered statistically significant. For content validity, S-CVI/Ave was computed as (sum of all item-level CVIs) / (number of items). Detailed statistical methods for content validity, face validity, convergent validity, construct validity, and reliability are presented in their respective subsections above.

Ethical rules

This study was approved by Tabriz University of Medical Sciences' ethics committee (IR.TBZMED.REC.1401.218).

Results

Participant Characteristics

A total of 182 participants (69 males and 113 females) were enrolled, with a mean age of 46.0 ± 16.32 years. The Demographic and Clinical Characteristics of participants, based on gender, knee-side involvement, and clinical diagnosis, are presented in Table 1. The participants' LKSS and activity level, based on the Tegner score scale, were 58.39 ± 23.00 and 2.47 ± 1.29, respectively (mean ± SD). The average time required to complete the Persian LKSS was 3 minutes.

Table 1: Demographic and Clinical Characteristics (N = 182).

Variable	Category	N (%)	LKSS Mean ± SD	Tegner scale Mean ± SD
Gender	**Male**	69 (37.9)	61.33 ± 23.06	2.85 ± 1.53
	Female	113 (62.1)	56.60 ± 22.87	2.23 ± 1.06
Knee Involvement	**Right knee**	57 (31.3)	64.50 ± 20.41	2.75 ± 1.24
	Left knee	52 (27.6)	60.50 ± 20.03	2.55 ± 1.52
	Bilateral knees	73 (40.1)	52.12 ± 24.88	2.19 ± 1.10
Diagnosis	**ACL deficiency**	17 (9.3)	61.11 ± 18.86	2.64 ± 1.16
	ACL reconstruction	19 (10.4)	62.52 ± 19.83	2.31 ± 0.88
	Meniscal injury	40 (22.0)	72.15 ± 17.38	3.07 ± 1.42
	Patellofemoral pain syndrome	50 (27.5)	63.70 ± 20.25	2.82 ± 1.38
	Degenerative joint disease	56 (30.8)	41.60 ± 21.68	1.73 ± 0.88
Total		182 (100)	58.39 ± 23.00	2.47 ± 1.29

Note: LKSS: Lysholm Knee Scoring Scale; SD: Standard Deviation; ACL: Anterior cruciate Ligament

Validity

The CVI for all items in the Persian translation of the LKSS was acceptable (CVI> 0.79), so the questions did not need to be revised. The CVR for all questions, based on the number of experts (10 people), exceeded the acceptable level (0.62), and, as a result, the necessity of all questions was confirmed. Furthermore, the scale-level content validity index, calculated as the average of all item-level CVI scores (S-CVI/Ave), was 0.80, confirming excellent content validity for the overall Persian LKSS.

No signs of ceiling or floor effects in the total scores were observed, indicating that the tool accurately captured the full range of responses without aggregating at the extremes. A frequency analysis revealed that ≤15% of participants had the lowest possible (ceiling) or the highest possible (floor) scores. Descriptive statistics (skewness=-0.41, median=63.00, mean=58.40) confirm a well-distributed score. Considering that the impact score of all the questions is above 1.5, and therefore all the questions have face validity, and none of the questions were candidates for removal. The value of Pearson's Correlation Coefficient between the LKSS and IKDC scales was 0.804 (p=0.001), indicating a robust correlation between the two scales. The construct validity of the scale was assessed through exploratory factor analysis using data from 182 participants. The KMO index was equal to 0.829, and Bartlett's test was significant (p-value<0.001). The scree plot showed a clear, sharp drop in eigenvalues after the first factor, while the subsequent factors changed little (Figure 1). Therefore, the scale has a one-factor structure, with all items loading onto a single factor. Principal axis factoring (PAF) was used for initial factor extraction. To enhance interpretability, Orthogonal (Varimax) rotation was applied. The percentage of variance explained by one factor was 42.39%, which is an average value.

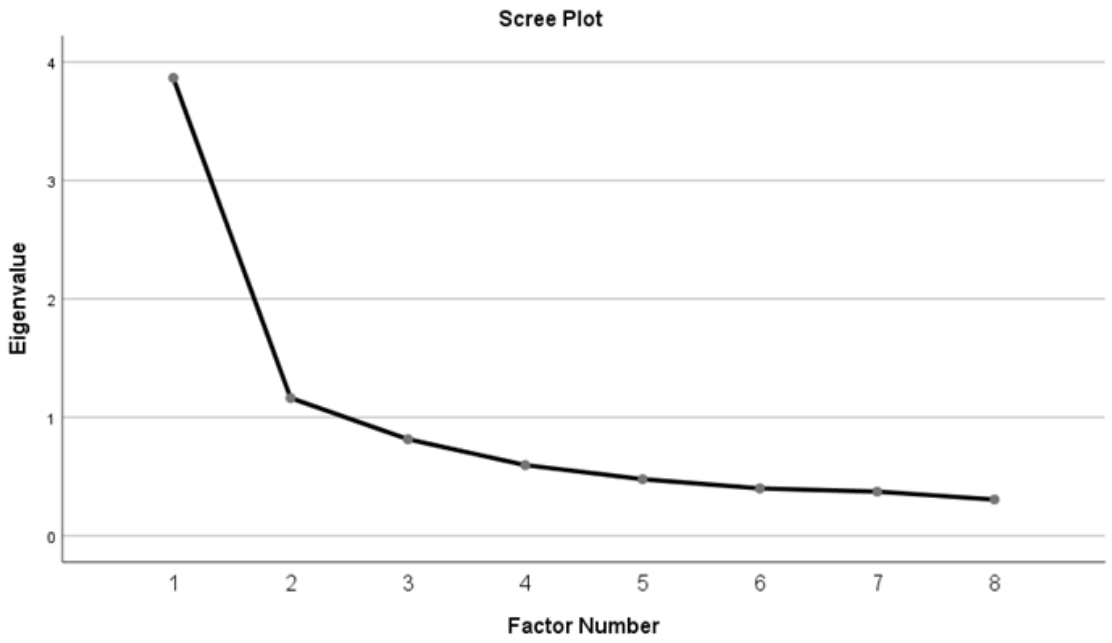

Figure 1. Scree plot of the Persian LKSS.

Reliability

The Cronbach's alpha for the LKSS was 0.894, indicating good internal consistency. The "Cronbach's alpha if item deleted" values for individual items ranged from 0.879 to 0.893, all close to the overall alpha, confirming that no single item disproportionately influenced the internal consistency (Table 2). Test-retest reliability was measured using the ICC. Sixty-two participants completed the LKSS again after 7 days. The ICC (2,1) for the LKSS was 0.95, which is excellent. The SEM value was 5.14 for the total score, as shown in Table 2.

Table 2: Reliability of the Persian LKSS.

Lysholm Items	ICC	CI 95%	Cronbach's alpha if item deleted	SD of the scores	SEM
Limp	0.89	0.83 – 0.93	0.891	1.69	0.56
Using can	0.98	0.96 – 0.99	0.893	1.45	0.21
Locking	0.89	0.82 – 0.93	0.888	4.69	1.56
Giving way	0.92	0.87 – 0.95	0.879	7.34	2.08
Pain	0.83	0.73 – 0.89	0.886	8.15	3.36
Swelling	0.94	0.90 – 0.96	0.885	4.11	1.01
Climbing	0.87	0.80 – 0.92	0.890	2.90	1.05
Squatting	0.85	0.76 – 0.91	0.892	1.96	0.76
Total	0.95	0.92 – 0.97	0.894	22.99	5.14

Note: ICC: Intraclass Correlation Coefficient (two-way random-effects model for absolute agreement); SEM: Standard Error of Measurement; CI: Confidence Interval; SD: Standard Deviation. Cronbach's alpha if item deleted values are presented for individual items; the overall Cronbach's alpha for the total scale was 0.894.

Discussion

In the present study, the content, face, convergent, and construct validity, as well as the reliability of the Persian version of the LKSS, were evaluated. The key findings included acceptable content and face validity, robust convergent validity, a one-factor structure, and excellent reliability in Persian-speaking patients with various knee pathologies.

In the present study, patients with various knee problems, including ACL deficiency or reconstruction, meniscal injuries, patellofemoral pain syndrome, and degenerative joint disease, were included, which is consistent with the LKSS validation studies conducted in Turkish, Arabic, Italian, Thai, Portuguese, and Greek languages (2, 7, 8, 12, 13, 15). Although a very recent study validated the Persian Lysholm score exclusively in patients with ACL injury (18), our study extends these findings by validating the scale in a more diverse patient population, including meniscal injuries, patellofemoral pain syndrome, and degenerative joint disease. Furthermore, while Vosoughi et al. primarily focused on construct validity and reliability, our study additionally provided a comprehensive assessment of content validity (CVR and CVI) and face validity (impact score), which were not quantitatively reported in their validation (18). It has been shown that the LKSS has been validated across various knee conditions, and including a more diverse sample of patients with different knee disorders would have enhanced the generalizability of the results.

Content validity was checked by using CVR and CVI. The CVI was higher than 0.79 for all items; therefore, the questions did not need to be revised (20). Also, the CVR values for each question were acceptable and confirmed the necessity of all the questions. In this study, the impact score for all questions was above 1.5, which was acceptable. To date, the content and face validity of the LKSS have not been quantitatively assessed in validation studies of its various versions.

The convergent validity of the LKSS was assessed using the IKDC. A powerful and statistically significant correlation was found between the LKSS and the IKDC ($r = 0.804$, $p < 0.001$), indicating good convergent validity. In four studies, the IKDC was also used to assess the convergent validity of the LKSS across different versions. The reported correlation coefficients between the LKSS and IKDC were 0.735 for the Greek version (10), 0.83 for the Dutch version (11), 0.73 for the Chinese version (7), and 0.89 for the Thai version (15). Although participants in the Chinese and Dutch versions were homogeneous and all had ACL injuries, the Greek and Thai versions, similar to the present study, included individuals with a variety of knee problems.

The construct validity of the LKSS was supported by an exploratory factor analysis (EFA) that revealed a one-factor structure. The adequacy of the sample was confirmed by a KMO value of 0.829, and Bartlett's test ($p < 0.001$) indicated that the data were suitable for factor analysis. A precise inflection after the first factor in the scree plot suggested a strong single-factor solution. According to the factor analysis, this study showed a satisfactory percentage of the total variance explained by one factor at 42.39%, indicating that the one-factor model explains 42.39 of the total variances of the data. This level of explained variance is considered acceptable in health-related scales and supports the theoretical assumption that the LKSS measures a single underlying construct, knee function. These findings are consistent with the Spanish version, which showed a one-factor structure and a satisfactory total variance of 51.5% (8).

This version of the LKSS demonstrated good internal consistency (Cronbach's alpha = 0.894), consistent with findings from other validation studies reporting values ranging from 0.70 to 0.91 (2, 7-11, 13, 15-17). Generally, a Cronbach's alpha coefficient of 0.7 or higher is sufficient to confirm internal consistency (23-29). Also, the Persian version showed excellent reliability (ICC=0.95), consistent with other studies reporting values between 0.80 and 0.99 (2, 7-17). The

7-day interval between the test and retest in the present study was consistent with the Chinese (7), Indonesian (13), Spanish (8), and Dutch (11) versions of the LKSS. To minimize the risk of clinical changes, participants did not receive any treatment during this period. In other versions, the test-retest interval varied from 48 hours to 14 days. According to the Cosmin guideline, the test-retest interval should be long enough to prevent recall bias, yet short enough to ensure that the clinical condition remains stable (24-29).

In this study, the SEM was calculated as 5.14. The acceptability of an SEM value depends on the magnitude of the measured values and the acceptable error limits for the instrument. In an estimated value around 100 units (as in the LKSS), an SEM of 5.14 (5.14%) can be considered acceptable. The SEM value obtained in the present study is comparable to findings of the Dutch (SEM=3.3), Indonesian (SEM=1.8), Greek (SEM=3.36), Thai (SEM=4.8), and German (SEM=7.87) versions of the LKSS (10-13, 15, 30-31).

Limitations

This study had several limitations. First, test-retest reliability was assessed in only 62 participants due to practical constraints, and a larger sample would have strengthened the findings. Second, not all psychometric properties of the Persian version of the LKSS were evaluated; specifically, responsiveness and minimal meaningful change were not assessed and require investigation in future studies. Finally, like many nations, Iran is a multicultural country with multiple languages spoken across its regions. The current Persian version of the LKSS is suitable only for Persian-speaking individuals, limiting its applicability among non-Persian-speaking populations in the country.

Conclusion

Based on the results of the present study and studies in this field, the Persian version of LKSS is a suitable tool for evaluating knee condition in people with knee injuries. The Persian version of the LKSS has content, face, and construct validity, as well as high reliability, and can be used as an evaluation tool in the health system.

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Conflict of Interest Statement

The authors declare that they have no conflicts of interest relevant to the content of this study.

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Author' contributions

JA: Conceptualization, Methodology, Supervision, Writing - original draft; and Writing - review & editing.

HA: Conceptualization, Supervision, Investigation, Writing - original draft; and Writing - review & editing.

BA and F.F: Data curation, Investigation, Visualization; Writing - original draft.
PS: Methodology, Writing - original draft; and Writing - review & editing.
SP and F.F: Data curation, Investigation, Writing - original draft; and Writing - review & editing.

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