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Cultural Adaptation and Confirmatory Factor Analysis of the Urdu Translation of the Short Medication Adherence Scale (SMAS-7-Urdu)

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ABSTRACT

Medication adherence is one of the key determinants of the effectiveness of treatment and health outcomes worldwide. Culturally appropriate and psychometrically sound instruments are required for its accurate assessment. The present study aimed to translate and culturally validate Short Medication Adherence Scale (SMAS-7) in Urdu for use in Pakistan. A correlational research design was used to execute this study in two phases. Phase I involved translation and cultural adaptation of SMAS-7 in Urdu using the standardized guidelines including forward translation, synthesis, backward translation, expert committee review and pilot testing. Pilot testing aimed to assess clarity and comprehensibility of the translated scale. Phase II focused on psychometric evaluation and cultural validation of the Urdu version of SMAS-7 (SMAS-7-Urdu) using a sample of 224 bilingual adults recruited through convenience sampling. The findings indicated strong semantic, conceptual and cultural equivalence between the original scale and SMAS-7-Urdu. Content validity indices demonstrated excellent expert agreement regarding item relevance and clarity. SMAS-7-Urdu showed satisfactory internal consistency ($\alpha = .87$) and strong test-retest reliability ($r = .89$, $p < .001$). T-test showed no significant differences between English and Urdu version of SMAS-7. Confirmatory Factor Analysis (CFA) supported the original three-factor structure of the SMAS-7 and demonstrated good model fit indices ($\chi^2/df = 1.69$, CFI = .989, TLI = .979, GFI = .977, RMSEA = .056). Overall, the findings support SMAS-7-Urdu as a reliable, valid and culturally appropriate measure for assessing medication adherence in Pakistani populations. SMAS-7-Urdu will facilitate clinical assessment, research and intervention planning in healthcare settings.

Introduction

Medication adherence is a fundamental determinant of effectiveness of the treatment and overall health outcomes. The World Health Organization (WHO) defines medication adherence as the degree to which a person takes medicine, follows dietary recommendations and implements lifestyle modifications according to the recommendations of a healthcare provider (Sabaté, 2003). Adherence is essential to achieve optimal therapeutic outcomes in acute and chronic illnesses and poor adherence compromises treatment efficacy and contributes to disease progression and complications leading to increased mortality (Lam & Fresco, 2015). Despite of the substantial advancements in healthcare systems and pharmacological therapies medication non-adherence remains a major unresolved public health challenge worldwide. Studies consistently indicate that approximately 50% of individuals with chronic conditions fail to adequately adhere to long-term treatment regimens, thereby reduce the effectiveness of medical interventions and compromise patient well-being (Sabaté, 2003; Schnorrerova et al., 2024).

Consequences of medication non-adherence extend beyond the health outcomes of individuals and significantly burden healthcare systems and societies. Non-adherence has been associated with increased rate of hospitalization, disease exacerbation, poor quality of life and escalated healthcare expenditures due to repeated consultations and treatment requirements (Nassar et al., 2022; Schnorrerova et al., 2024). Schnorrerova et al. (2024) emphasized that non-adherence affects not only patients but also healthcare providers, caregivers, families and healthcare systems which leads to utilization of increased healthcare service causing economic strain. Consequently, improving medication adherence has become a central concern for clinicians, researchers and policymakers with an intension to enhance effectiveness of the treatment and to reduce avoidable healthcare costs.

Medication adherence is a complex and multidimensional phenomenon influenced by a wide range of interacting factors. According to WHO, adherence is shaped by the factors related to patients, therapy, health condition, socioeconomic status and healthcare system (Sabaté, 2003). Patients intentionally discontinue medication due to beliefs regarding medication inefficacy, fear of side effects or cultural misconceptions about treatment, whereas unintentional non-adherence occur because of forgetfulness, financial difficulties, low health literacy or complicated medication regimens (Chan et al., 2020; Yoon et al., 2023). Schnorrerova et al. (2024) highlighted that medication adherence is influenced by treatment complexity, cognitive functioning, lifestyle factors, social stigma and economic barriers such as poverty and inadequate health coverage. Similarly, Moore et al. (2023) identified that cost of medication, forgetfulness, treatment burden, side effects and poor health literacy are major barriers contributing to reduced adherence behaviors across clinical populations which indicate that medication adherence is deeply embedded within psychological, social, economic and cultural contexts.

Medication adherence has multidimensional nature hence its accurate assessment is important to identify non-adherent patients and plan effective interventions for them. Several methods are developed to measure adherence which include pill counts, pharmacy records, digital monitoring systems, therapeutic drug monitoring and self-report questionnaires. Objective measurement methods like medication event monitoring systems (MEMS) and therapeutic drug monitoring provide relatively reliable estimates of adherence but they are often expensive, invasive and impractical for routine use in clinical settings in low-resource healthcare settings (Mason et al., 2022). Self-report questionnaires remain the most commonly used adherence assessment methods as they are inexpensive, easy to administer and capable of identifying behavioral and psychological barriers associated with non-adherence (Schnorrerova et al., 2024). However, many

available adherence measuring tools are either disease-specific, extensive or culturally restricted, thereby limit their application across diverse populations and healthcare settings.

In response to these limitations, need for culturally sensitive medication adherence tool gained attention. Cultural beliefs, explanatory models of illness, social norms and patient-provider interactions substantially influence medication-taking behaviors and interpretations of questionnaire items by patients (Yoon et al., 2023). Therefore, adherence measures developed within one cultural context cannot accurately capture adherence behaviors in another setting without appropriate translation and cultural adaptation. Commonly used adherence measures fail to account for cultural, psychological and socioeconomic factors affecting adherence within diverse populations adequately (Bou Serhal et al., 2018). Lebanese Medication Adherence Scale (LMAS) was developed to incorporate culturally relevant psychological, occupational, economic and annoyance-related dimensions influencing medication adherence and it demonstrated good psychometric properties and accurate prediction of managed hypertension as compared to MMAS-8 which highlight the importance of culturally grounded adherence measures (Bou Serhal et al., 2018).

Building upon this culturally informed framework, Sakr et al. (2025) developed Short Medication Adherence Scale (SMAS-7) as a concise multidimensional instrument intended to assess medication adherence in different chronic and acute health conditions. SMAS-7 is a short and more feasible version of the LMAS demonstrating its essential psychological, behavioral and economic dimensions. SMAS-7 demonstrates satisfactory psychometric properties through factor analysis, internal consistency and stability over time which indicate its usefulness as a practical screening instrument in clinical and research settings. Importantly, the development of the SMAS-7 addressed the growing need of brief adherence tools suitable for resource-limited healthcare environments.

Translation and cultural validation of any scale is essential to ensure conceptual equivalence, linguistic clarity and contextual relevance across different populations. Translation without cultural adaptation can compromise validity of the scale and increase measurement bias as some concepts, expressions and beliefs related to the target behaviors are not interpreted similarly across different cultures. Beaton et al. (2000) emphasized that systematic cross-cultural adaptation procedure is necessary to maintain both semantic and conceptual equivalence of translated self-report measure with the original measure. In populations with different preferred languages culturally validated instruments ensure comprehension, reduced information bias and reliability of the findings. Furthermore, brief and culturally adapted scales are valuable in healthcare systems as they consume limited time, workforce and financial resources and provide rapid adherence screening to support timely intervention and care planning.

Urdu is the national language of Pakistan and is widely understood across diverse educational and socio-cultural groups. Hence, lack of a translated and culturally adapted instruments hinders accurate assessment among individuals with limited proficiency in English. Therefore, the aim of the present study is to translate and culturally validate Short Medication Adherence Scale (SMAS-7) for use with Urdu-speaking individuals in Pakistan. By evaluating the linguistic equivalence and psychometric properties of the translated version, this study provides healthcare professionals and researchers a concise, reliable and culturally appropriate instrument to measure medication adherence in people. Availability of Urdu version of SMAS-7 (SMAS-7-Urdu) will facilitate early identification of non-adherent behaviors, guide targeted interventions and contribute to improved treatment outcomes and healthcare delivery.

Method

Research Design

Correlational research design was used to translate and culturally validate Short Medication Adherence Scale (SMAS-7) into Urdu as the national language of Pakistan. The study aimed to establish linguistic equivalence, cultural appropriateness, reliability and validity of the Urdu version of the scale (SMAS-7-Urdu). Translation and adaptation process followed internationally recognized standardized guidelines proposed by Debra E. Beaton et al. (2000) to warrant semantic, idiomatic, conceptual and experiential equivalence between the original and translated versions of the instrument (Zafar et al., 2026).

Instruments

Short Medication Adherence Scale (SMAS-7; Sakr et al., 2025) was the primary instrument used in this study which consists of 7 items developed to assess multidimensional aspects of medication adherence across different chronic and acute conditions of illness. The SMAS-7 measures behavioral, psychological and economic dimensions which influence medication-taking behaviors in individuals. Responses are recorded on a Likert-type response format and higher scores indicating greater medication adherence. SMAS-7 demonstrate satisfactory psychometric properties through factorial validity, internal consistency and temporal stability overtime (Sakr et al., 2025).

Phases of the Study

Phase I: Translation and Cultural Adaptation

Participants

In this phase, bilingual linguistic and subject-matter experts (N = 11) from the fields of psychology, linguistics, psychometrics and general medicine were recruited based on their proficiency in both English and Urdu languages and expertise in scale development, adaptation or validation.

Procedure

The translation and cultural adaptation process followed a structured 5-step model proposed by Beaton et al. (2000), resulting in a pre-final Urdu version of the SMAS-7.

1. **Forward Translation:** Two independent bilingual experts translated English version of the SMAS-7 in Urdu.

2. **Synthesis of Translation:** Translated versions were compared and synthesized into a single reconciled Urdu version through consensus among experts.

3. **Backward Translation:** Two independent translators translated the synthesized Urdu version back into English being blinded to the original scale to evaluate conceptual equivalence.

4. **Expert Committee Review:** An expert committee reviewed all versions of the scale to evaluate semantic, conceptual, experiential and idiomatic equivalence. Content validity was assessed using the Content Validity Index (CVI).

5. **Pre-testing:** The pre-final Urdu version was pilot tested to assess clarity, comprehensibility and cultural appropriateness of the translated items.

Pilot Testing

Participants. Urdu-speaking adult individuals (N = 28) representative of the target population were recruited through convenience sampling for pilot testing.

Procedure. The pre-final Urdu version of the SMAS-7 was administered to participants to evaluate the three major components of pilot testing including clarity and readability, comprehensibility and cultural appropriateness of the translated items. Participants were encouraged to provide feedback regarding ambiguous wording, difficulty in understanding items and cultural relevance of the statements. Based on participant feedback and expert recommendations, minor modifications were incorporated to finalize the Urdu version of the SMAS-7.

Phase II: Psychometric Evaluation and Cultural Validation

Participants

In this phase, 224 adults including both males and females ranging in age from 18 to 60 years were recruited through convenience sampling from hospitals and clinical settings. Individuals with proficiency in both English and Urdu languages were recruited in the sample to enable accurate evaluation of language equivalence and psychometric properties across the English and Urdu versions of the scale.

Procedure

Informed consent was obtained after providing standardized set of instructions and participants were asked to complete a protocol comprising a demographic information sheet, the English version of the SMAS-7, the Urdu version of the scale (SMAS-7-Urdu). Data was collected through both online and paper-pencil formats depending upon accessibility and preference of the participant. Participants were informed regarding the voluntary nature of participation and right to withdraw from the study at any stage without penalty.

To establish language equivalence, T-test was used to compare the mean scores of the participants on both English and Urdu versions of the SMAS-7. Psychometric evaluation of the Urdu version included assessment of internal consistency, test-retest reliability and cultural validation. Confirmatory Factor Analysis (CFA) was conducted using IBM SPSS AMOS to validate the three-factorial structure of the Urdu version of the SMAS-7 proposed by the original authors of the scale for cultural validation. Model fit was evaluated using multiple good-fit and bad-fit indices according to recommended cutoff criteria reported in the literature.

Ethical Considerations

The study observed ethical principles defined by the American Psychological Association (2018) for research involving human participants. Approval was obtained from the institutional review board of the parent institute prior to data collection. All participants were informed regarding the aims and objectives of the study, their role and rights as research participants and electronic informed consent was obtained preceding to participation. Participation was entirely voluntary and participants were informed about their right to withdraw at any stage without any consequences. Confidentiality and anonymity were strictly maintained by anonymizing participant information and securely storing collected data for research purposes only. Participants were also informed that they could skip any item they felt uncomfortable answering.

Data Analysis

Data were analyzed using IBM SPSS Statistics Version 27 and IBM SPSS AMOS Version 24. Content validity during Phase I was assessed using the Content Validity Index (CVI). Descriptive statistics were computed during pilot testing to evaluate clarity and comprehensibility of the translated items. Confirmatory Factor Analysis (CFA) was conducted using AMOS to evaluate the cultural validity and factorial structure of the Urdu version of the SMAS-7 based on the proposed three-factor model of the original scale. Statistical significance was determined at $p < .05$.

Results

Phase I: Translation and Cultural Equivalence

The translation and cultural adaptation of the Short Medication Adherence Scale (SMAS-7) demonstrated a high degree of semantic, conceptual, idiomatic and experiential equivalence between the original English and Urdu versions of the scale. Subjective comparison between the original instrument and the back-translated English version indicated substantial consistency in item meanings. Out of the 7 items, 6 items showed direct equivalence with the original English version, whereas 1 item required minor linguistic refinement related to wording clarity and contextual appropriateness. These refinements were incorporated after discussion and consensus by the experts to ensure fidelity with the original SMAS-7. Committee of experts further evaluated the Urdu translated version of SMAS-7 for semantic, idiomatic, experiential and conceptual equivalence. Item-Level Content Validity Index (I-CVI) values ranged from .92 to 1.00 for all items of the Urdu version of SMAS-7 and Scale-Level Content Validity Index (S-CVI/Ave) was .96. These findings indicated strong agreement among experts regarding the relevance, clarity and cultural appropriateness of the translated items as no major conceptual modifications were suggested at this stage (Shi et al., 2012).

Pilot Testing

Findings of pilot testing indicated that majority of the participants found Urdu translation of SMAS-7 easy to understand, culturally relevant and comprehensible as the language used in the scale items was clear and admissible for the Urdu speaking population. Minor wording refinements were suggested for improving readability. Consequently, the final Urdu translation of the SMAS-7 (SMAS-7-Urdu) was established and considered linguistically accurate and culturally appropriate without any apparent conceptual deviation from the original instrument.

Phase II: Psychometric Evaluation and Cultural Validation

Internal consistency SMAS-7-Urdu was assessed using Cronbach's alpha coefficient ($\alpha = .87$) which indicated satisfactory reliability and suggested that the items consistently measure the construct of medication adherence. Language equivalence between the English and Urdu versions of the SMAS-7 was observed through paired sample *t*-test analysis which indicated no statistically significant difference between the mean scores of the English and Urdu versions of the scale ($t = .71$, $p = .479$) suggesting that both English and Urdu versions produce comparable score distributions and are functionally equivalent across languages. Furthermore, test-retest reliability analysis conducted over one-week interval demonstrated strong temporal stability of SMAS-7-Urdu ($r = .89$, $p < .001$).

To establish cultural validity and examine the factorial structure of the Urdu version of the SMAS-7, Confirmatory Factor Analysis (CFA) was conducted using IBM SPSS AMOS Version 24 on a sample of 224 participants. The CFA tested the proposed three-factor structure identified by the original authors of the scale. The model demonstrated an adequate to good fit to the data, $\chi^2(11) =$

18.57, p = .069, with a chi-square to degrees of freedom ratio (χ^2/df) of 1.69 which indicated acceptable model fit. Additional goodness-of-fit indices further supported the adequacy of the proposed three-factor model. The Comparative Fit Index (CFI) was .989, Tucker-Lewis Index (TLI) was .979, Incremental Fit Index (IFI) was .989 and Goodness-of-Fit Index (GFI) was .977, all exceeding the recommended cutoff value of .90. The Root Mean Square Error of Approximation (RMSEA) was .056 with a PCLOSE value of .371 which indicated a close approximation of the model to the observed data. Similarly, the Root Mean Square Residual (RMR) value of .019 indicated minimal residual error and further confirmed good model fit.

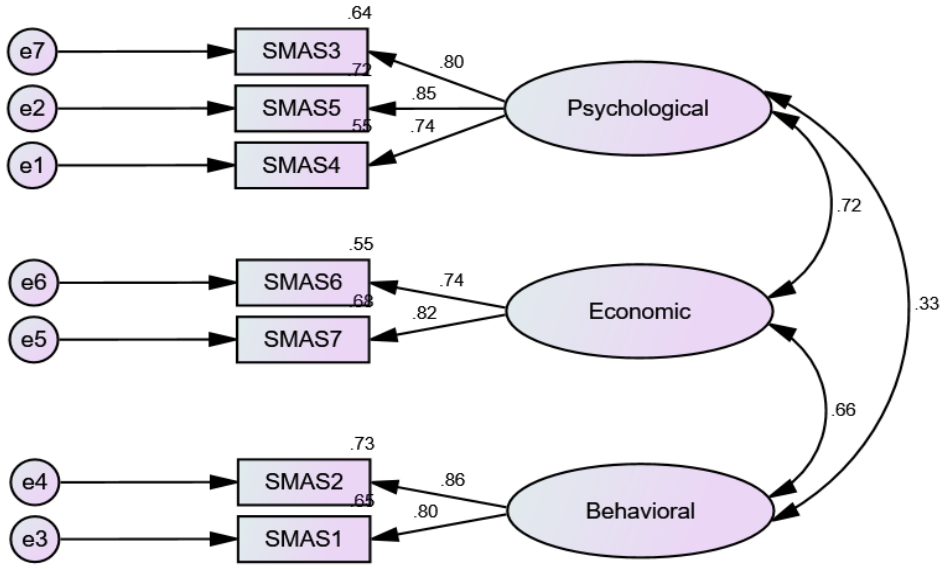


Figure 1: Standardized estimates of factor loadings of SMAS-7-Urdu

The standardized factor loadings for the three-factor model (Figure 1) ranged from .742 to .856 which indicated strong relationships between observed items and their respective latent constructs. Specifically, factor loadings for Factor 1 ranged from .743 to .848, for Factor 2 ranged from .805 to .856 and for Factor 3 ranged from .742 to .824. All factor loadings were statistically significant (p < .001), supporting the construct validity of SMAS-7-Urdu.

The squared multiple correlations (R^2) for the items ranged from .551 to .732 which indicated that a substantial proportion of variance in the observed variables was explained by their respective latent factors. Among three latent factors significant positive correlations were observed ranging from .329 to .716 which suggested that the dimensions of medication adherence measured by the scale are related yet distinct constructs.

The findings of reliability analysis, language equivalence testing and confirmatory factor analysis collectively supported the psychometric adequacy and cultural validity of the Urdu version of Short Medication Adherence Scale (SMAS-7-Urdu).

Discussion

The present study aimed to translate, culturally adapt and psychometrically validate the Urdu translation of Short Medication Adherence Scale (SMAS-7-Urdu) for use with the people in Pakistani to assess the medication adherence. The findings demonstrated that the SMAS-7-Urdu possesses satisfactory linguistic equivalence, cultural appropriateness, reliability and construct

validity which support its utility as a brief multidimensional instrument for assessing medication adherence in Urdu-speaking individuals.

Translation and cultural adaptation process ensured a high degree of semantic, idiomatic, experiential and conceptual equivalence between the original English version and the Urdu-translated version of the SMAS-7. The use of a structured translation model based on the guidelines proposed by Beaton et al. (2000) contributed in maintaining the integrity of the original construct while ensuring cultural relevance for the target population. Expert evaluation further supported the appropriateness of the translated items reflected by high Item-Level and Scale-Level Content Validity Index values. These findings are consistent with previous cross-cultural adaptation studies which emphasized that rigorous translation procedures are essential for preserving conceptual equivalence and reducing information bias in psychological and behavioral measures (Beaton et al., 2000; Hallit et al., 2020; Zafar et al., 2026).

The pilot testing phase further confirmed that SMAS-7-Urdu was comprehensible, culturally appropriate and easy to understand for the Urdu-speaking population. Minimal difficulty in understanding the items was reported by the participants and only minor linguistic modifications were suggested. These findings ensured that the translated scale adequately captures culturally relevant expressions and experiences associated with medication adherence behaviors within the Pakistani context. Culturally adapted instruments are necessary to ensure accurate assessment of adherence behaviors across diverse populations as it is strongly influenced by social beliefs, literacy levels, communication styles and cultural perceptions regarding medication use (Yoon et al., 2023).

The Urdu version of SMAS-7 demonstrated satisfactory internal consistency which ensured that the items consistently measure the multidimensional construct of medication adherence. The obtained Cronbach's alpha coefficient was comparable with the findings reported in the original validation study of SMAS-7 (Sakr et al., 2025) which supported the reliability of SMAS-7-Urdu. These findings are aligned with previous medication adherence research which demonstrated that brief self-report adherence scales provide reliable estimates of medication-taking behavior when appropriately adapted and validated (Lam & Fresco, 2015; Schnorrerova et al., 2024).

Language equivalence analysis revealed that there was no statistically significant difference between the English and Urdu versions of SMAS-7 which suggested that both the versions are functionally equivalent with comparable score distributions. Additionally, strong test-retest reliability indicated temporal stability of SMAS-7-Urdu over time. These findings collectively supported the linguistic fidelity of translated instrument and confirmed that the Urdu version reproduces reliable conceptual meaning of the original scale. It was important to establish language equivalence in bilingual populations because inconsistencies between versions can compromise validity and affect the interpretation of adherence behaviors in Urdu-speaking population.

An important contribution of the present study was the cultural validation of the SMAS-7 through Confirmatory Factor Analysis (CFA). The CFA findings supported the three-factor structure identified by the original authors which indicated that the multidimensional conceptualization of medication adherence explained in SMAS-7 is applicable within the Pakistani cultural context as well. The obtained model fit indices including CFI, TLI, GFI, RMSEA and RMR which collectively demonstrated good model fit according to recommended criteria (Goretzko et al., 2024). Furthermore, all standardized factor loadings were statistically significant and ranged within acceptable limits suggesting that the observed items adequately represented their respective latent constructs.

Replication of original three-factor structure in this study is important as it demonstrates cross-cultural stability of the underlying dimensions of medication adherence assessed by SMAS-7. Medication adherence is recognized as a multidimensional phenomenon encompassing behavioral, economic and psychological domains rather than a single behavioral act of taking medication (Sakr et al., 2025; Schnorrerova et al., 2024; Serhal et al., 2018). Validation of this structure within the Pakistani population indicates that similar multidimensional factors influence medication adherence behaviors across culturally diverse settings.

The findings of this study have some important implications as Pakistan faces considerable healthcare challenges related to chronic disease management, low health literacy, financial barriers and inconsistent treatment adherence so, in such situations, brief and culturally validated scale to measure adherence is valuable because it can facilitate rapid screening and identification of non-adherent individuals in both clinical and community healthcare settings. In comparison with the lengthy adherence measures SMAS-7-Urdu provides a concise, feasible and cost-effective alternative suitable for clinical assessment and large-scale research studies with Urdu-speaking population to identify adherence-related barriers associated with economic burden, medication beliefs, forgetfulness and treatment-related difficulties. Early identification of these barriers can help in the development of targeted interventions focusing on psychoeducation and behavioral modifications to improve treatment compliance and health outcomes. The scale can also be useful to evaluate adherence patterns among individuals with chronic illnesses like hypertension, diabetes, cardiovascular diseases and psychiatric conditions where medication adherence is recorded as a persistent challenge.

Despite its strengths, the present study has some limitations that should be acknowledged as well. Use of convenience sampling has limited the generalizability of the findings to the broader Pakistani population. Future research should examine the application of the SMAS-7-Urdu across diverse educational and regional populations within Pakistan. Future studies should be designed to evaluate the predictive validity and clinical utility of the SMAS-7-Urdu across different medical conditions and healthcare settings. Future longitudinal studies planned to examine the relationship between SMAS-7-Urdu scores and treatment outcomes will provide additional evidence regarding its effectiveness as a screening and monitoring tool.

To conclude, the present study provides empirical support for the reliability, linguistic equivalence and cultural validity of the Urdu version of the Short Medication Adherence Scale (SMAS-7-Urdu). The findings indicate that the SMAS-7-Urdu is a psychometrically sound and culturally appropriate instrument to assess medication adherence within the Urdu-speaking Pakistani population. The availability of SMAS-7-Urdu as a brief, reliable and culturally validated adherence measure can facilitate research, improve clinical assessment and contribute to the development of targeted interventions to enhance medication adherence and overall healthcare outcomes.

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