Clinical Validity of the Repeatable Battery for the Assessment of Neuropsychological Status among Patients with Schizophrenia in the Republic of Armenia†

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Abstract

There is considerable interest in Armenia toward advancing research and applying evidence-based practice in the treatment of schizophrenia. An area of research that has made little progress is the standardization of reliable and valid tests to measure cognitive functions. The aim of the present study was twofold. The first goal was to adapt the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) into Armenian. The second purpose was to examine the clinical validity of the Armenian-language RBANS in patients diagnosed with schizophrenia and healthy comparison controls. Seventy-seven patients with DSM IV TR diagnosis of schizophrenia or schizoaffective disorder, and 77 healthy individuals participated in the study. The cognitive performance of patients was compared with that of healthy controls and U.S. normative data. The Armenian-language RBANS demonstrated acceptable psychometric properties in terms of test validity and reliability. Relative to healthy controls, patients with schizophrenia exhibited impaired performance in all RBANS Index and Subtest tasks. Patients and comparison controls performed below the U.S. data with the greatest differences found in language and attention tasks. The present findings support that the Armenian-language RBANS is a good test for measuring cognitive functions in patients with schizophrenia and the general population. The performance differences between Armenian and U.S. samples highlight the limitation in using English-standardized normative data for cross-cultural studies. The results merit further investigation to disentangle cultural variations from cognitive disturbances.

Keywords: Test construction; Schizophrenia; RBANS

Introduction

Armenia, situated in Eastern Europe/Southwest Asia, is the smallest of the former Soviet Union republics. Treatment of mental disorders in Armenia has a long tradition that dates back to ancient practices, folk remedies, and psychosocial and neurobiological interventions (for a review, see Minasyan, 2009). Modern practices, however, are derived primarily from the
Russian-Soviet conceptualization of mental functions. Historically, Russian medicine had advanced in close contact with progressive trends in American and European psychiatry (Glozman, 2007; Vein & Maat-Schieman, 2008). However, the Bolshevik revolution, and ideological constraints on most aspects of civil society, including abuse of psychiatric diagnoses (Bloch & Reddaway, 1977), led to the deterioration of relations with Western countries (van Voren, 2010). The ultimate resignation of the Soviet All-Union Society of Psychiatrists from the World Psychiatric Association (WPA) ceased communication between the Soviet Republics and the international mental health community (Rich, 1983; Wynn, 1983).

In light of Alexander Luria’s pioneering research in the field of neuropsychology (Hutton, Arsenina, Kotik, & Luria, 1977; Luria, 1965), understanding cognitive processes and disturbances was at the forefront of Soviet science (Glozman, 2007). The bulk of this work, however, was the clinical observation of brain and behavior rather than the development of standardized tests. Neuropsychological advances were also centralized in the Moscow school of psychiatry and had little impact in the clinical care of patients in the Soviet Republic of Armenia. Furthermore, intelligence and cognitive testing was a sensitive topic and subject of ideological inferences. For example, in 1936, a decree by the Communist Party of the Soviet Union titled “On pedagogical perversions in the Narkompros system” prohibited the assessment of mental and sensory abilities in the Soviet education system (Kozulin, 1984; Takooshian & Trusov, 1992). The use of psychological tests was considered to claim innate individual differences that did not exist and were incompatible with the ideals of unlimited development.

On September 21, 1991, the Soviet Union collapsed and the independent Republic of Armenia was founded. The post-Soviet status of research and treatment of mental disorders in Armenia is imbued with Soviet and Western approaches. The most frequent diagnosis in state psychiatric hospitals is schizophrenia, and treatment consists of pharmacological and recreational therapies. First-generation antipsychotics, notably, haloperidol and trifluoperazine, are the most common form of state supported medications. There are no social or behavioral therapies and most mental health professionals are unfamiliar with adjunctive evidence-based nonpharmacological therapies.

There is renewed interest in Armenia toward advancing research and applying evidence-based practice in the treatment of schizophrenia. An area of research that has made little progress is the standardization of reliable and valid tests to measure cognitive functions. The major factors that impede progress include unfamiliarity with test construction, access to peer-reviewed journals, and inadequate governmental research funding. The aim of the present study was twofold. The first goal was to adapt the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) into Armenian. The second purpose was to examine the clinical validity of the Armenian-language RBANS in patients diagnosed with schizophrenia and healthy comparison controls. Previous studies support that RBANS is a good screening measure of cognitive functions in patients with schizophrenia (Green et al., 2008; Hobart, Goldberg, Bartko, & Gold, 1999; Loughland, Lewin, Carr, Sheedy, & Harris, 2007; Wilk et al., 2002). The availability of normative data from the U.S. sample of schizophrenia patients (Gold, Queerm, Iannone, & Buchanan, 1999; Randolph, 1998; Wilk et al., 2004) also provides an opportunity to compare the performance of patients in Armenia with that of another country.

Materials and Methods

Participants

Seventy-seven patients with DSM IV TR diagnosis of schizophrenia or schizoaffective disorder, and 77 healthy control individuals participated in the study. Demographic and clinical characteristics of patients and comparison controls are presented in Table 1. The patients were drawn from inpatient state psychiatric hospitals in Yerevan and Armash Province of Armenia. Diagnosis was confirmed using a best-estimate approach, combining semi-structured interview, medical chart review, and information from collateral informants. Patients were clinically stable at the time of testing and were taking conventional antipsychotics. Haloperidol and trifluoperazine were the most commonly used agents, accompanied by anticholinergic agents. Exclusion criteria included the history of traumatic brain injury, neurological diseases, developmental disability, substance abuse, or dependence (with the exception of nicotine-dependence) within the last 6 months.

Healthy controls were recruited from the Yerevan district and were hospital and university affiliated staff, friends, and relatives. Control participants were excluded if they reported a personal or family history of mental illness, history of traumatic brain injury, prescription medication that might have affected mood, substance abuse, or dependence (with the exception of nicotine dependence) within the last 6 months. All study participants were native Armenians with the exception of three patients (one Kurd, and two Yazidis). Armenian fluency was a requirement for participation. Research participants were volunteers and did not receive compensation. Ethical approval for the study was given by the Research Ethics Committee from the Yerevan State Medical University. All participants provided verbal informed consent after the study procedures were explained.
Adaptation

RBANS adaptation into Armenian was done in several steps following the American Psychological Association’s Ethical Principles of Psychologists and Code of Conduct (Standard 9; American Psychological Association, 2002), International Test Commission Guidelines for Translating and Adapting Tests (International Test Commission, 2010), and a review of literature on test adaption (Hambleton, 2005; Reynolds, 2000). First, permission to translate the RBANS into Armenian was obtained from the test author and the respective test copyright holder. Second, the RBANS (Form A) was translated into Armenian language by an Armenian-English bilingual psychologist and a professional translator with a background in psychological testing. Verbal test items were translated with a conceptual (e.g., cultural relevance, number of syllables, phonemes) rather than a literal focus. Third, the test was back translated into English using an independent professional translator. The differences in the forward and the backward translation processes were reconsolidated. Fourth, a pilot study was carried out with five research participants that were fluent in Armenian. These individuals provided input about the clarity of test materials and the test-taking experience. Last, translators and reviewers met to resolve discrepancies and reach a consensus of the final translation. The final forward and backward translations were sent to the test copyright holder.

Measures

Each study participant was individually administered the Armenian-language RBANS and scored according to the standard instructions in the test manual (Randolph, 1998). The RBANS is composed of 12 subtests that are grouped into five scaled Index scores and a Total Scale score. Test indices are Immediate Memory (comprised of List Learning plus Story Memory tasks), Visuospatial/Constructional (comprised of Figure Copy plus Line Orientation tasks), Language (comprised of Picture Naming plus Semantic Fluency tasks), Attention (comprised of Digit Span plus Coding tasks), and Delayed Memory (comprised of List Recall, Story Recall, Figure Recall, plus List Recognition tasks). The Index scores are summed to form the RBANS Total score, which is a global measure of cognitive performance. Each Index score is expressed as a scaled score with a mean of 100 and a standard deviation of 15 based on a U.S. normative standardization study (Randolph, 1998). The administration time for the Armenian-language RBANS was approximately 20 min for the controls and 30 min for the patients. The patients in the study were also rated on the Positive and Negative Syndrome Scale (Kay, Fiszbein, & Opler, 1987).

Data Analysis

The RBANS Index and Subtest scores were first evaluated for normality of distribution and homogeneity of variance. Cronbach’s $\alpha$ was calculated to determine the internal consistency of the Five Index and the Total Scale score. Test–retest reliability using Pearson’s $r$ and intraclass correlation coefficient (ICC) was computed for 15 patients and 15 healthy controls.
The demographic variables between patients and comparison controls were compared using t-tests and \( \chi^2 \) tests for continuous and categorical variables, respectively. Multivariate analysis of variance (MANOVA) on Index and Subtest scores was used to investigate group differences on RBANS indices, with group (patients and controls) as between factor and test scores as within factor. Cohen’s \( d \) values were computed to estimate the effect sizes of the magnitude of differences in test performance. A series of one-sample t-tests (Bonferroni corrected) were used to compare mean Index scores of the current research participants with the U.S. standardized normative data. Pearson’s and Sperman’s correlation coefficients were calculated to determine the relationship between test performance with age and education. The \( p \)-value for all analysis performed was set at .01. Statistical analyses were carried out using SPSS 16.0 for Windows 2000 (SPSS, Chicago, IL, USA).

Results

Clinical and Demographic Characteristics

Clinical and demographic characteristics for patients with schizophrenia and comparison controls are reported in Table 1. The two groups did not differ significantly in age—\( t(152) = 0.31, p > .05 \)—and gender ratio—\( \chi^2(1, n = 75) = 0.33, p > .05 \). Relative to healthy controls, most patients had not completed high school—\( \chi^2(1, n = 55) = 6.56, p = .01 \)—and were currently single—\( \chi^2(1, n = 87) = 17.48, p < .001 \).

Internal Consistency and Test–Retest Reliability

Intercorrelations between the RBANS Five Index and the Total Scale score are presented in Table 2. Because the pattern of intercorrelations and the magnitude of Cronbach’s \( \alpha \) were similar in patients and comparison controls, the subsequent analyses were combined. Cronbach’s \( \alpha \) calculated using the Total score and the Five Index scores was 0.92, suggesting a high degree of internal consistency. The inter-item correlations between the Total Scale score and other cognitive Indices ranged from .74 (Visualspatial Construction) to .88 (Delayed Memory). The Cronbach’s \( \alpha \) for RBANS Subtests was 0.85 with an average inter-item correlation of .47 (range from .29 to .81). Test–retest reliability data for 30 research participants (15 patients and 15 control participants) that were tested 2–3 weeks apart are presented in Table 3. Reliability data for the patients with schizophrenia ranged from 0.62 to 0.84; those for controls ranged from 0.64 to 0.89.

Criterion Validity

RBANS Index and Total Scale mean performance for patients and healthy controls are presented in Fig. 1. The distributions of raw scores for each of the RBANS Index scores met the normality assumption and were not transformed. MANOVAs

### Table 2. Pearson’s correlation coefficients between the RBANS Index and the Total Scale scores, all research participants (\( N = 154 \))

<table>
<thead>
<tr>
<th></th>
<th>Immediate Memory</th>
<th>Visualspatial Construction</th>
<th>Language</th>
<th>Attention</th>
<th>Delayed Memory</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Score</td>
<td>.87</td>
<td>.74</td>
<td>.80</td>
<td>.86</td>
<td>.88</td>
<td>—</td>
</tr>
<tr>
<td>Delayed Memory</td>
<td>.76</td>
<td>.61</td>
<td>.62</td>
<td>.67</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Attention</td>
<td>.71</td>
<td>.58</td>
<td>.62</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Language</td>
<td>.65</td>
<td>.48</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Visualspatial Construction</td>
<td>.46</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**Notes:** RBANS = Repeatable Battery for the Assessment of Neuropsychological Status. All correlations are significant at \( p < .001 \) (two-tailed).

### Table 3. Test–Retest Reliability of RBANS Index and Total Scale scores

<table>
<thead>
<tr>
<th>RBANS Index Scales</th>
<th>Patients (( n = 15 ))</th>
<th>Controls (( n = 15 ))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pearson’s ( r )</td>
<td>Reliability (ICC)</td>
</tr>
<tr>
<td>Immediate Memory</td>
<td>.73</td>
<td>0.74</td>
</tr>
<tr>
<td>Visualspatial Construction</td>
<td>.76</td>
<td>0.78</td>
</tr>
<tr>
<td>Language</td>
<td>.62</td>
<td>0.62</td>
</tr>
<tr>
<td>Attention</td>
<td>.84</td>
<td>0.84</td>
</tr>
<tr>
<td>Delayed Memory</td>
<td>.77</td>
<td>0.76</td>
</tr>
<tr>
<td>Total Score</td>
<td>.79</td>
<td>0.82</td>
</tr>
</tbody>
</table>

**Notes:** RBANS = Repeatable Battery for the Assessment of Neuropsychological Status; ICC = intraclass correlation coefficient.
comparing the performance of patients with schizophrenia, and controls were used to examine group differences on RBANS Five Index and Total Scale scores. A significant omnibus difference for RBANS performance between the two groups was found—Wilk’s $\lambda(1,147) = 25.50$, $p < .001$. The results of the follow-up independent $t$-tests indicated that patients performed significantly worse than the control group on all RBANS Index and Total Scale scores: Immediate Memory—$t(152) = 8.33$, $p < .001$, Cohen’s $d = 1.34$; Visualspatial Constructional—$t(152) = 7.07$, $p < .001$, Cohen’s $d = 1.14$; Language—$t(152) = 7.67$, $p < .001$, Cohen’s $d = 1.23$; Attention—$t(152) = 11.68$, $p < .001$, Cohen’s $d = 1.88$; Delayed Memory—$t(152) = 8.72$, $p < .001$, Cohen’s $d = 1.40$; and Total Scale score—$t(152) = 11.65$, $p < .001$, Cohen’s $d = 1.87$. The results remained significant even when multivariate analysis of covariance was carried out adjusting for years of education attained—Wilk’s $\lambda(2,153) = 22.6$, $p < .001$.

RBANS Subtest mean raw scores for patients and controls are presented in Table 4. Examination of raw score distributions revealed that the following subtests were skewed negatively and were leptokurtic: Figure Copy, Picture Naming, and Recognition. Logarithmic transformations were performed on these measures resulting in acceptable normality. All Subtest scores were then standardized to $z$-scores for statistical analyses. MANOVAs comparing the performance of patients with schizophrenia, and healthy controls were used to examine group differences on RBANS Subtest scores. A significant omnibus difference for RBANS performance between the two groups was found—Wilk’s $\lambda(1,141) = 21.12$, $p < .001$. The results of the follow-up independent $t$-tests indicated that patients performed significantly worse than the control group on all RBANS Subtests. Cohen’s effect sizes for RBANS Subtests ranged from 2.36 to 0.62, with the Digit Coding test showing the biggest effect size.

Comparison with U.S. Patients

The comparison of RBANS Index scores between the current patients relative to the U.S. data is presented in Fig. 2. Relative to the U.S. patients recruited from outpatients and inpatient schizophrenia clinics (Wilk et al., 2004), the current patients performed more poorly on Language Indices—$t(76) = 8.41$, $p < .001$; Attention Indices—$t(76) = 12.46$, $p < .001$; and Total Score Indices—$t(76) = 2.95$, $p < .01$. The performance on the Visualspatial Constructional was higher than the U.S. sample—$t(76) = 3.13$, $p < .01$—and no difference was obtained for Immediate Memory. It should be noted that the current healthy controls also performed lower than the RBANS normative data (Randolph, 1998) on Attention Indices, $t(76) = 10.61$, $p < .001$ and Language Indices, $t(76) = 7.80$, $p < .001$. 

Fig. 1. RBANS Mean Index Scale and Total Scale scores for patients with schizophrenia and healthy controls. All group effects are significant at $p < .001$. Bars display the standard deviations. The dashed line shows the U.S. standardized RBANS means.
Association with Demographic Variables

Age and education correlations with the RBANS Index and Subtest scores are presented in Table 5. In the patient group, age was positively correlated with Delayed Memory ($r = .33, p < .01$), whereas among comparison controls, age was positively correlated with both Delayed Memory ($r = .39, p < .001$) and Total Score ($r = .38, p < .01$). RBANS Index scores are age-corrected and the meaning of these correlations is unclear. For RBANS Subtests (age uncorrected), age was negatively correlated with Coding performance in the comparison controls ($r = - .35, p < .01$) but not the patient group. Education was positively correlated with most RBANS Index and Subtest scores ($r$-values ranged from $- .15$ to $.51$), with higher test performance corresponding to higher levels of education.

Discussion

The absence of standardized instruments is an obstacle in advancing research and improving the clinical care of people with schizophrenia in the Republic of Armenia. The primary aim of the present study was to adapt the RBANS into Armenian and evaluate the clinical validity of this test in patients diagnosed with schizophrenia and healthy controls. Our findings showed that
the Armenian-language RBANS was linguistically and conceptually equivalent to the original (English) version. Patients exhibited worse performance than healthy controls on all RBANS Index and Subtests indicating severe cognitive impairment. The magnitude of cognitive deficits was similar to other studies (e.g., Randolph, 1998; Wilk et al., 2004) wherein patients with schizophrenia scored approximately 1.5–2 SD below comparison controls.

We also examined differences between the present sample and the U.S. data obtained from patients with schizophrenia. The Armenian patients demonstrated greater deficit than the U.S. patients on Language and Attention Indices. These differences, however, must be interpreted in light of healthy controls performing below the U.S. standardized norms on Language and Attention Indices as well. It should be noted that the U.S. normative sample was stratified according to age, sex, ethnicity, education, and geographic region of the U.S. population. The current control sample, however, was matched to the demographics of the patient group and was not representative of the entire Armenian population. Notably, the comparison control sample had fewer years of education than the national average and studies support that a higher level of education is associated with better RBANS performance (e.g., Gold, Queern, Iannone, & Buchanan, 1999; Wilk et al., 2004). Performance differences, however, remained significant even after adjusting for years of education, pointing to the influence of other variables. These findings raise serious concerns in the direct use of normative data from other countries in the Republic of Armenia.

Racial differences in cognitive test performance are attributed to the range of factors from social context to innate cognitive abilities. The complexity of these issues is beyond the scope of our data but we suggest some possible explanations for the cross-cultural discrepancies on language and attention tasks. Russian language played a dominant role in the education and social life of Soviet Armenia, and majority of Armenians are bilingual in Armenian and Russian. Bilinguals differ in their linguistic abilities and score lower than monolingual individuals on verbal fluency tests (e.g., Portocarrero, Burright, & Donovick, 2007). Thus, bilingual-adjusted stratified data might be needed to ensure accurate assessment of language abilities.

The attention domain, however, is far less sensitive to adaptation and linguistic issues. The RBANS Attention Index is comprised of Digit Span and Coding (also known as the Digit Symbol Substitution; Wechsler, 2008) tests. Performance difference between the current patients and comparison controls on the Coding test yield a large effect size ($d = 2.36$) and was greater than the effects derived for all other subtests. A recent meta-analysis (for a meta-analysis, see Dickinson, Ramsey, & Gold, 2007) identified Coding as the single most practical test in discriminating patients with schizophrenia from comparison controls. Our results are consistent with this view, but also demonstrate that Coding processes are affected, at least in part, with cultural factors. The performance of the current control group was also lower than the U.S. normative data. Interestingly, Russian-language adaption of RBANS also found that Russian-speaking healthy immigrants living in the U.S. scored

| Table 5. Correlations of RBANS Index and Subtest scores with age and education |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| RBANS                      | Patients                    | Education effects           | Controls                    |
|                            | Age effects                 | Education effects           | Age effects                 |
| Immediate Memory           | .20                         | .35*                        | .21                         |
| List Learning              | -.06                        | .18                         | -.04                        |
| Story Memory               | .06                         | .29                         | -.03                        |
| Visualspatial              | .14                         | .29                         | .23                         |
| Figure Copy                | -.04                        | .12                         | -.11                        |
| Line Orientation           | .06                         | .22                         | -.06                        |
| Language                   | .22                         | .34*                        | .22                         |
| Picture Naming             | .14                         | .29                         | .05                         |
| Semantic Fluency           | -.27                        | -.01                        | .06                         |
| Attention                  | .20                         | .46**                       | .24                         |
| Digit Span                 | -.08                        | .24                         | -.02                        |
| Coding                     | -.09                        | .35*                        | -.35*                       |
| Delayed Memor              | .33*                        | .47**                       | .39**                       |
| List Recall                | .19                         | .37**                       | .01                         |
| List Recognition           | -.04                        | .27                         | .00                         |
| Story Memory               | .20                         | .36*                        | -.03                        |
| Figure Recall              | -.13                        | .22                         | -.19                        |
| Total Score                | .27*                        | .51**                       | .38**                       |

Note: RBANS = Repeatable Battery for the Assessment of Neuropsychological Status.

*Age associations were assessed with Pearson’s correlation coefficients.

*Education associations were assessed with Spearman’s rho.

*Significant at the $p < .01$.

**Significant at the $p < .001$. 

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below-average in the attention domain, but average in all other cognitive domains (Bluvshtein, 2004). The Coding test measures multiple mental operations including the perceptual-motor speed during copying, visual scanning, and incidental learning (Joy, Fein, & Kaplan, 2003). Perhaps, these mental operations had little adaptive function in the daily lives of Armenians and did not advance to a processing speed that is normative of Western countries. Alternatively, slowness in information processing might be related to the socioeconomic hardship that affected majority of the Armenians in the past two decades. An insightful interpretation proposed by one of the anonymous reviewers of this manuscript suggested that “…in contrast to most other countries, the American educational system emphasizes speedy responding, training students to reply quickly. If this is not the case in the Armenian (or Russian) educational system, then perhaps the healthy Armenians had lower scores on Coding not necessarily because of socioeconomic hardship (although that might also be the case), but because they were never trained in the process of speedy responding.”

Besides cultural factors, the severity of cognitive deficits among the Armenian patients in comparison to the U.S. studies might have resulted from the common use of conventional antipsychotic drugs, unavailability of psychosocial therapies, and socioeconomic differences. The only type of state supported medication in Armenia’s state psychiatric hospitals is conventional antipsychotics. While still inconclusive, research suggests that conventional antipsychotics have limited effects on cognition, whereas new-generation compounds might have some modest cognitive benefits (Bilder et al., 2002; Keefe, Silva, Perkins, & Lieberman, 1999). There is also little or no psychosocial therapy in state psychiatric hospitals. The care of schizophrenia is exclusively under the domain of psychiatry and most psychiatrists are unfamiliar or dismissive of adjunctive psychosocial therapies. Finally, the socioeconomic situation in Armenia provides inadequate resources for the care of people with schizophrenia and related disorders.

One limitation of the present study was the unavailability of other Armenian-language cognitive tests to examine convergent and divergent validity of the RBANS. We are currently working toward the adaptation of MATRICS Consensus Cognitive Battery (MCCB; Kern et al., 2008; Nuechterlein et al., 2008) into Armenian and will have a comparison test in the future. Another limitation was using the RBANS Form A for test and retest reliability. The RBANS offers two alternate forms (Forms A and B) to minimize practice effects but the second form is not available in Armenian. Irrespective, test and retest reliability of RBANS Form A yield a high level of reliability in both patient and control groups. Last, our subject recruitment method was based on opportunity rather than a random sampling. The clinical sample was restricted to the group of patients that were clinically stable and curious to participate in an Armenian version of an American test. The findings may not reflect the overall cognitive characteristics of patients with schizophrenia in the Republic of Armenia. In light of these limitations, the Armenian-language RBANS is a good test for measuring cognitive functions and can provide new opportunities for cross-cultural studies.

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**Conflict of Interest**

None declared.

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