The Repetitive Behavior Scale-Revised: Independent Validation in Children with Autism Spectrum Disorders and a Control Group in Albania

Anita Pilika
PhD, Faculty of Medicine, Neuroscience Department, Psychiatric Service (University Hospital Center Mother Teresa), Tirana, Albania

Abstract
A key feature of autism is restricted repetitive behavior (RRB). Despite the significance of RRBs, little is known about their phenomenology, assessment, and treatment. The objective of this study is the validation of the Albanian version of the RBS-R in an independent sample of ASD children. In order to validate the RBS-R in an independent sample, a survey was conducted in Albania at National Center of Childrens’ Rehabilitation including 30 children with autism spectrum disorders (ASD) and a control group of 30 children without ASD. Factor analyses produced a five-factor solution that was both clinically meaningful and statistically sound, namely: Ritualistic/Sameness Behavior, Stereotypic Behavior, Self-Injurious Behavior, Compulsive Behavior and Restricted Interests. Measures of internal consistency were good for this five-subscale solution. The effects of baseline characteristics (age and gender) were examined. Cronbach’s alpha was used to measure internal consistency. The alpha values for the five subscales, ranged from 0.72 (Stereotypic) to 0.85 (Ritualistic/ Sameness Behavior). All values are within or above the acceptable range for research purposes. The Albanian version of RBS-R appears to have sound psychometric characteristics and can be used to differentiate various types of repetitive behaviors.

Keywords: Autism, Repetitive behavior, Stereotypies, Assessment, Rating scale

Introduction
In recent years, much of the work on the features of autism has focused on core social and communication deficits of the disorder, rather on restricted and repetitive behavior, which is also a core feature (Lewis & Bodfish, 1998; Rutter, 1996).
In order to address more complex RRBs observed in people with autism, Bodfish and colleagues expanded the original RBS to include more complex RRBs by adding items assessing ritualized behaviors, insistence on sameness, and restricted interests. This resulted in the current 43-item RBS-R. Items are rated on a four-point Likert scale ranging from (0) "behavior does not occur" to (3) "behavior occurs and is a severe problem," and raters are asked to refer to the previous month when completing the scale. The items of the RBS-R have been conceptually grouped (i.e., based on clinical experience) into six subscales. These include: (a) Stereotyped Behavior (movements with no obvious purpose that are repeated in a similar manner); (b) Self-injurious Behavior (actions that cause or have the potential to cause redness, bruising, or other injury to the body); (c) Compulsive Behavior (behavior that is repeated and performed according to a rule or involves things being done "just so"); (d) Ritualistic Behavior (performing activities of daily living in a similar manner); (e) Sameness Behavior (resistance to change, insisting that things stay the same); and (f) Restricted Behavior (limited range of focus, interest, or activity).

The objective of the present study was to assess the factor structure and some psychometric characteristics of the RBS-R in an independent sample of children with autism spectrum disorders and a control group of children without ASD in Albania. It was hypothesized that the six-factor structure of the RBS-R would be confirmed via exploratory factor analysis.

**Method**

**Participants**

The participants in the factor analytic study of the RBS-R were 30 children with autism spectrum disorders (ASD) at National Center of Children's Rehabilitation in Tirana, Albania and a control group of 30 children without ASD matched for age and gender in order to assess the effects of subject variables on repetitive behavior.

**Instrument**

Translational validity was undertaken to ascertain whether the content of the questionnaire was appropriate and relevant to the study purpose. All questionnaires were completed by the same interviewer, thus, eliminating the interviewer's bias.

**Data Analysis**

The analyses was carried out on the whole sample using the software SPSS 16.0. Mean scores were calculated for both cohorts and compared. A p-value <0.05 indicated statistical significance. Normality of distribution was tested and data of a significant
nature had non-parametric tests conducted. To evaluate the internal consistency of the measures Cronbach's alphas were calculated for each of the RBS-R subscales and full scale, for the first and second measurement. To examine the construct validity of the RBS-R, exploratory factor analysis was performed first. A principal component extraction was used, after which the number of factors was determined by both eigenvalues (>1) and the scree test.

**Results**

Age ranged from 3 years to 9 years with a mean of 15.34 (SD = 9.60; median = 13.0). Ratio of gender was 2:1, males/females, for both ASD children and Control group. There were 20 males (67%) and 10 females (33%).

The comparison of means between ASD and Control for the RBS-R in the beginning of the study yielded significant difference between them for all subscales and full scales highlighting the substantial occurrence of repetitive behavior among ASD children compared to the controls. (Table 1).

**Table 1. Comparison of Means between ASD and Control for the RBS-R in the beginning of the study**

| Subscale       | ASD Mean (SD) | Control Mean (SD) | t   | P     |
|----------------|---------------|-------------------|-----|-------|
| Stereotypic    | 7.8 (6.4)     | 2.1 (3.3)         | -5.4| <0.01 |
| Self-Injurious | 4.8 (7.5)     | 0.7 (2.1)         | -4.6| <0.01 |
| Compulsive     | 9.5 (8.2)     | 2.6 (4.7)         | -5.5| <0.01 |
| Ritualistic    | 7.5 (5.8)     | 2.0 (3.6)         | -8.5| <0.01 |
| Sameness       | 14.9 (9.2)    | 2.5 (5.3)         | -6.4| <0.01 |
| Restricted Interests | 6.3 (4.7)     | 1.5 (2.7)         | -6.6| <0.01 |
| Total score    | 50.8 (41.8)   | 11.4 (21.6)       | -4.4| <0.01 |

**Factor Analysis of the RBS-R**

The rate of endorsement was calculated on the basis of dichotomous (present/not present) data, which were created by collapsing severity ratings 1 through 3. None of the items were eliminated; the frequency of endorsement ranged from 13.3% (item 13: “Inserts finger or object”) to 66.7% (item 40: “videotapes”). Table 2.
Exploratory factor analysis using the inter-item correlation matrix from the 43 items of the RBS-R. 12 eigenvalues were extracted accounting for 81.6% of the total variance.

5 eigenvalues were retained accounting for 59.3% of the total variance.

The number of factors to retain was guided by: (a) the scree plot method (b) eigenvalues above 1.0 (c) interpretability.

The extraction method was Principal Component Analysis.

The number of factors to retain was guided by: (a) the scree plot method (b) eigenvalues above 1.0, and (d) interpretability. Solutions between two and six-factors were evaluated using these criteria. Items were adopted as loading on a given factor if (a) they loaded 0.35 or higher on that factor. Examination of the factor solutions indicated that either a four-or five factor solution could be adopted.

The five-factor solution with promax rotation was chosen as most appropriate for this sample due to interpretable factors. In comparing this five-factor solution with original six subscales, the main difference is that the five-factor solution collapsed the original Ritualistic Behavior and Sameness Behavior subscales into one (“Ritualistic/Sameness”) subscale.

Ritualistic Behavior means “performing activities of daily living in a similar manner,” and Sameness Behavior means “resistance to change, insisting that things stay the same.” It makes clinical sense that performing a ritual is strongly related to a need for sameness and consistency, as the present factor analysis indicates. Although the original Ritualistic Behavior subscale is oriented more towards activities and the Sameness Behavior subscale includes more references to specific objects, they share the construct of the need for invariance in both activities and in the environment.

Another important difference emerged by the present study in regard to Restricted Interests subscale. One of this subscale’s four items did not load on one-factor, one item (item 41: Attached to object) resolved onto “Ritualistic/Sameness” subscale.

Given the small sample size the subscales encompass the minimum set of three items to consider loading on a factor. The subscales meet the minimum standards in terms of factorial structure.

The mean factor loadings for factors I through V were 0.71, 0.69, 0.66, 0.61 and 0.62, respectively.
Table 2. Frequency of endorsement

| Stereotypy Subscale          | Frequency of endorsement | %   |
|------------------------------|--------------------------|-----|
| Body movements               | 25                       | 41.7|
| Head movements               | 28                       | 46.7|
| Finger movements             | 32                       | 53.3|
| Locomotion                   | 36                       | 60.0|
| Object usage                 | 21                       | 35.0|
| Sensory                      | 31                       | 51.7|
| **Self-Injurious Subscale**  |                          |     |
| Hits w/ body                 | 17                       | 28.3|
| Hits against surface         | 14                       | 23.3|
| Hits w/ object               | 11                       | 18.3|
| Bites self                   | 17                       | 28.3|
| Pulls hair/skin              | 9                        | 15.0|
| Rubs/scratches               | 8                        | 13.3|
| Inserts finger/object         | 8                        | 13.3|
| Picks skin                   | 14                       | 23.3|
| **Compulsive Subscale**      |                          |     |
| Ordering                     | 38                       | 63.3|
| Completeness                 | 25                       | 41.7|
| Washing                      | 19                       | 31.7|
| Checking                     | 28                       | 46.7|
| Counting                     | 27                       | 45.0|
| Hoarding                     | 27                       | 45.0|
| Repeating                    | 26                       | 43.3|
| Needs to touch/tap           | 17                       | 28.3|
| **Ritualistic Subscale**     |                          |     |
| Eating/mealtime              | 26                       | 43.3|
| Sleeping/bedtime             | 25                       | 41.7|
| Self care routine            | 31                       | 51.7|
| Transportation routine       | 34                       | 56.7|
| Play/leisure routine         | 28                       | 46.7|
| Communication                | 31                       | 51.7|
| **Sameness Subscale**        |                          |     |
| Placement of objects         | 26                       | 43.3|
| No new places                | 31                       | 51.7|
| No interruption              | 31                       | 51.7|
| Walks certain way            | 16                       | 26.7|
| Sits certain place           | 11                       | 18.3|
| Appearance/behavior of others| 32                       | 53.3|
| Uses certain door            | 22                       | 36.7|
| Videotapes                   | 40                       | 66.7|
| Difficult transitions        | 32                       | 53.3|
Insists on routine 30 50.0
Insists on time 32 53.3

**Restricted Subscale**
Preoccupation with subject 36 60.0
Attached to object 25 41.7
Preoccupied with part of object 25 41.7
Preoccupation with movement 34 56.7

**Table 3. Five-factor principal components analysis**

| Factors                                                                 | 1     | 2      | 3      | 4      | 5      |
|------------------------------------------------------------------------|-------|--------|--------|--------|--------|
| **Stereotypy Subscale**                                                |       |        |        |        |        |
| Head movements                                                         |  .596 |        |        |        |        |
| Finger movements                                                       |  .757 |        |        |        |        |
| Object usage                                                           |  .727 |        |        |        |        |
| Sensory                                                                |  .595 |        |        |        |        |
| **Self-Injurious Subscale**                                            |       |        |        |        |        |
| Hits w/ body                                                           |  .805 |        |        |        |        |
| Hits against surface                                                   |  .722 |        |        |        |        |
| Hits w/ object                                                         |  .707 |        |        |        |        |
| Rubs/scratches                                                         |  .830 |        |        |        |        |
| Inserts finger/object                                                  |  .392 |        |        |        |        |
| **Compulsive Subscale**                                                |       |        |        |        |        |
| Completeness                                                           |  .484 |        |        |        |        |
| Checking                                                               |  .647 |        |        |        |        |
| Hoarding                                                               |  .626 |        |        |        |        |
| Repeating                                                             |  .588 |        |        |        |        |
| Needs to touch/tap                                                    |        |  .767  |        |        |        |
| **Ritualistic/ Sameness**                                              |       |        |        |        |        |
| Sleeping/bedtime                                                       |  .683 |        |        |        |        |
| Self care routine                                                      |  .763 |        |        |        |        |
| Transportation routine                                                 |  .763 |        |        |        |        |
| Play/leisure routine                                                   |  .658 |        |        |        |        |
| Communication                                                          |  .716 |        |        |        |        |
| Placement of objects                                                   |  .728 |        |        |        |        |
| Appearance/behavior of others                                         |  .682 |        |        |        |        |
| Videotapes                                                             |  .682 |        |        |        |        |
| Difficult transitions                                                  |  .708 |        |        |        |        |
| Insists on routine                                                     |  .812 |        |        |        |        |
| Insists on time                                                        |  .695 |        |        |        |        |
| **Restricted Subscale**                                                |       |        |        |        |        |
| Preoccupied with part of object                                        |        |  .530  |        |        |        |
| Preoccupation with movement                                           |        |  .690  |        |        |        |
**Item-total Correlations**

Subscale scores were calculated by taking the integer weightings (0 – 3) scored by the interviewer and totaling them for all items in the subscale. As a way of validating the five-factor structure, item-total correlations were calculated. Each of the remaining 27 items on the RBS-R was correlated with the subscale scores (item-deleted) of Ritualistic/Sameness Behavior, Self-injurious Behavior, Stereotypic Behavior, Compulsive Behavior, and Restricted Interests. All items correlated most highly with their hypothesized subscale (Table 3). The mean item-total correlation for Ritualistic/Sameness Behavior was 0.74 (range from 0.64 to 0.84); for Self-injurious Behavior, 0.62 (range from 0.42 to 0.83); for Stereotypic Behavior, 0.63 (range from 0.53 to 0.80); for Compulsive Behavior, 0.69 (range from 0.45 to 0.85); and for Restricted Interests, 0.78 (range from 0.73 to 0.84). The RBS-R items are highly correlated to their own hypothesized subscales and moderately correlated to other subscales.

**Internal Consistency**

Cronbach’s alpha was used to measure internal consistency, which is the extent to which an item is correlated with the remaining items from its subscale. The alpha values for the five subscales, listed in Table 4, ranged from 0.72 (Stereotypic) to 0.85 (Ritualistic/Sameness Behavior). All values are within or above the acceptable range for research purposes.

*Table 4: Internal Consistency and Item-scale correlation of RBS-R (n = 60)*

| Scale                  | Coefficient alpha | Item-scale correlation | P value (2-tailed) |
|------------------------|-------------------|------------------------|--------------------|
| Stereotypic            | 0.72              | 0.55 - 0.80            | <0.01              |
| Self-Injurious         | 0.81              | 0.42 – 0.83            | <0.01              |
| Compulsive             | 0.80              | 0.45 – 0.85            | <0.01              |
| Ritualistic/Sameness   | 0.85              | 0.64 – 0.84            | <0.01              |
| Restricted Interests   | 0.70              | 0.73 – 0.84            | <0.01              |
| Whole scale            | 0.92              | ----                   |                    |

**Reliability/stability over time**

The analysis of responses between the test and the retest was conducted using Spearman non-parametric statistical test to compute the correlations between subscales of the first and second measurement. Correlation coefficients *r* ranged from 0.94 – 0.99. The Wilcoxon non-parametric statistical test was used for the full scale to determine whether there were any significant differences between the responses at each time point: P value for ASD was 0.98 and for Control was 0.87.
The high correlation between the scores at the two time points along with non-significant differences in the P values at the level of 0.05 in the responses to the items between the two tests indicates the instrument is stable over time.

**Effects of Subject Characteristics on RBS-R Scores**

In an effort to evaluate the effect of subject characteristics: (a) the age was split age (0 through 5 years, 6 through 9 years) (b) gender (male, female), for both ASD children and Control.

**Gender.** A trend \((p < 0.05)\) for a gender effect was found on the stereotypic subscale, with males showing higher levels of occurrence than females. Table 5.

**Age.** There is no significant trend for age for the six subscales and for the total score.

| Subscale          | Male Mean (SD) | Female Mean (SD) | t   | P    |
|-------------------|----------------|------------------|-----|------|
| Stereotypic       | 9 (6)          | 5.4 (6.1)        | -2.2| 0.04 |
| Self-Injurious    | 5.4 (7.9)      | 3.8 (6.3)        | -1.4| 0.2  |
| Compulsive        | 8.7 (8.3)      | 11.2 (7.7)       | 1.2 | 0.2  |
| Ritualistic       | 7.2 (5.7)      | 8.1 (6.3)        | 0.7 | 0.5  |
| Sameness          | 13.5 (9.4)     | 15.9 (8.3)       | 0.7 | 0.5  |
| Restricted Interests | 6.3 (4.8) | 6.4 (4.7)        | 0.1 | 0.9  |
| Total score       | 50 (42.1)      | 50.8 (39.4)      | 0.06| 0.9  |

**Discussion**

As far as could be determined, this is the first study in print to determine the subscale structure of the RBS-R through factor analysis in Albania. Although the results do not fully support Bodfish and colleagues’ conceptually-derived six-subscale structure, the solutions are quite similar overall. The current study has a disadvantage of a relatively small sample size over Bodfish’s principal components analysis. Hence, the five-factor solution is likely to be more stable and reproducible than the original six subscale approach, although this will need to be addressed through subsequent research.

The psychometric characteristics of the 5-subscale version of the RBS-R appear to be sound. The finding that the RBS-R can be used to differentiate various types of repetitive behaviors is an important step in the study of autism in Albania. Autism is a very complex, heterogeneous disorder, and the RBS-R may be particularly useful in identifying subgroups that may have prognostic or diagnostic utility. In addition, the RBS-R may be a useful tool in the assessment of treatment effects. The current
findings also suggest that the expression of RRB in autism may be modulated by a multitude of subject characteristics, and these relationships require further study. It is clear that repetitive behavior is highly correlated with the overall severity of autism, which provides further evidence for their clinical significance.

Although the study of repetitive behavior is in its infancy relative to the study of the social and communication domains in autism in Albania, the validation of the RBS-R provides an important step towards their future study.

Overall, the five-subscale, 27-item scoring method for the RBS-R appeared to have sound psychometric characteristics. The RBS-R may be used in the assessment of treatment effects and the course of the illness.

Crohnbach’s alphas for all of the subscales were satisfactorily high. However, the restricted interests factor is a weakness of this subscale and more research is needed in the future to avoid any kind of bias arising from small sample size and from the language of the questionnaire.

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