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# Research feature

## Toward data-based clinical decision making for adults with challenging behavior using the Behavior Problems Inventory-Short Form (BPI-S)

Darren L. Bowring, Vasiliki Totsika, Richard P. Hastings and Sandy Toogood

### Abstract

**Purpose** – *The Behavior Problems Inventory-Short Form (BPI-S) is a shorter version of the Behavior Problems Inventory-01. In this paper, BPI-S population norms are reported from a total administrative population of adults with intellectual disability (ID). To facilitate the use of the BPI-S in clinical services to assess behavior change, the purpose of this paper is to describe how to use BPI-S clinically significant and reliable change (RC) scores.*

**Design/methodology/approach** – *Data were gathered on 265 adults with ID known to services. Proxy informants completed the BPI-S on challenging behaviors over the previous six months. Clinically significant cut-off values and RC scores were calculated using the Jacobson and Truax's (1991) method.*

**Findings** – *BPI-S clinical reference data are presented to provide benchmarks for individual and group comparisons regarding challenging behavior. Examples demonstrate how to use clinical norms to determine change.*

**Practical implications** – *Behavior change is a major goal of researchers and practitioners. Data from the present study can make the BPI-S a valuable tool for determining change in challenging behavior following service input or intervention.*

**Originality/value** – *Whilst well used in research, the BPI-S may be less extensively used in practice. This present study provides data to enable researchers and practitioners to use the BPI-S more widely in assessing clinical outcomes, such as intervention research and service evaluation.*

**Keywords** *Challenging behaviour, Assessment, Intellectual disability, Reliable change, Normative data, Behaviour Problems Inventory*

**Paper type** *Research paper*

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### Introduction

Recent population studies reveal a consistently high prevalence of challenging behavior in individuals with intellectual disabilities (IDs): prevalence estimates range from 18.1 percent (Bowring *et al.*, 2017) to 22.5 percent (Jones *et al.*, 2008). Given time and resource pressures, assessment of challenging behavior in this population is often undertaken using proxy reported standard behavior rating scales instead of direct behavior observation. Behavior rating scales, using data from individuals who know the person well, are useful for researchers and for services tasked with developing intervention approaches and needing to monitor behavior change.

The Behavior Problems Inventory-Short Form (BPI-S) is one such instrument. It assesses three of the most common challenging behavior topographies shown by individuals with ID: aggressive-destructive, self-injurious and stereotyped behaviors (Rojahn *et al.*, 2012a). The BPI-S is a standardised and reliable rating scale, with evidence of acceptable validity to assess challenging behavior in individuals with ID (Mascitelli *et al.*, 2015; Rojahn *et al.*, 2012a, b). It has been demonstrated to have adequate to good internal consistency (Bowring *et al.*, 2017; Mascitelli *et al.*, 2015; Rojahn *et al.*, 2012a, b), inter-rater agreement and test-retest reliability (Mascitelli *et al.*, 2015), strong evidence for confirmatory and discriminant validity (Rojahn *et al.*, 2012a, b); and confirmatory factor analysis has validated the three BPI-S subscales (Mascitelli *et al.*, 2015).

To support practitioners and researchers, it is essential to develop criteria for interpretation of BPI-S results obtained from individual and group assessments, especially over time (i.e. in the context of interventions). Population norms are useful to establish how an individual's behavior problem score compares to the general adult ID population. Population norms also provide a benchmark to assist comparison between studies, to identify individuals requiring support/intervention, and allow the estimation of numbers across populations with likely challenging behavior. Population norms may be useful to challenging behavior services at screening when evaluating case input, or to prioritise cases. Without points of comparison, interpreting the meaning of psychological assessments, such as the BPI-S, is difficult (Cicchetti, 1994).

Given the significant health and quality of life impact of challenging behavior on individuals with ID and their carers (Emerson *et al.*, 2001; Hastings and Brown, 2002; Cooper *et al.*, 2009), considerable clinical and financial investment is made in interventions for challenging behavior and also specialist challenging behavior services (McGill and Poynter, 2012). Outcome assessments are needed that can be used in regular clinical practice to show whether the amount of behavior change is meaningful and whether services are effective. Normative data can be further used in the generation of criteria to assess clinically significant change – a measure that is becoming increasingly more important in practice (Aardoom *et al.*, 2012). Clinically, significant change is demonstrated when a person moves outside the range of the “dysfunctional” population to within the range of the “functional” population (Jacobson and Truax, 1991).

The current paper describes how to assess individual and service level behavior change using the BPI-S. Examples are drawn from clinical practice to illustrate how to use the normative data, together with clinical and reliable change (RC) criteria for the BPI-S.

### Source of BPI-S data

BPI-S data were gathered from 265 persons  $\geq 18$  years of age administratively defined as having ID (i.e. who were receiving, or had received, support from services in Jersey). Participants represented 97 percent of eligible and traceable adults with ID in Jersey administrative records ( $n = 311$ ). This is a suitable sample for normative data, based on a clearly defined and well-represented population sample (Hopman *et al.*, 2000). There were no missing BPI-S data, which is a significant strength of the study. Full detail on participant identification, demographic information, consent, and ethics approval can be found in Bowring *et al.* (2017).

### The BPI-S

The BPI-S comprises 30 items across three subscales: self-injurious behavior (SIB) ( $n = 8$ ), aggressive-destructive behavior (ADB) ( $n = 10$ ), and stereotyped behavior (SB) ( $n = 12$ ). The BPI-S measures behaviors present during the previous six months, rated on a five-point frequency scale (never = 0; monthly = 1; weekly = 2; daily = 3; hourly = 4) and a three-point severity scale (mild = 1; moderate = 2; severe = 3). A behavior rated as mild for severity is defined as not causing significant damage to the individual or others (e.g. reddening of the skin). Moderate severity causes damage to the individual or others (e.g. bruising) and behavior rated as severe represents damage to the individual or others, requiring medical intervention, or causing damage to items beyond repair. Frequency and severity of behavior are measured for the SIB and ADB subscales, and frequency alone for the SB subscale. For each item, a score is generated by

multiplying the frequency and severity scores and the sum of these product scores generates a subscale score. The sum of the three subscales gives a BPI-S total score. Internal consistency in the present sample was good (coefficients reported in Bowring *et al.*, 2017).

## BPI-S population norms

To establish BPI-S norms, the prevalence of each item within the sample was calculated (*n*, %), and the frequency and severity scores summarised (%) (Table I). The overall prevalence of participants presenting at least one item behavior within each subscale was calculated (*n*, %), alongside the median, mean, standard deviation, range and variance of the BPI-S subscale and total scores (Table II). Norms are provided separately for men and women and for younger (18-40 years of age) and older (41+ years of age) adults (median sample age was 40 years).

Table II indicates that 41.13 percent of participants presented at least one behavior listed within the ADB subscale, 37.36 percent presented with at least one behavior in the SB subscale, and 24.15 percent for the SIB subscale. Overall, 58.49 percent of participants presented with behavior leading to the endorsement of at least one item in the BPI-S. Median BPI-S scores in the three subscales were 0 given the majority of participants did not present with a listed item behavior. Mean BPI-S product scores in each subscale were 3.28 for SB (SD = 6.59), 2.76 for ADB (SD = 5.52), and 1.59 for SIB (SD = 4.183). The BPI-S total mean score was 7.63 (SD = 12.83).

Mean BPI-S product scores were generally higher for males and younger participants, in particular for the ADB, SB, and BPI-S total scales. SIB product scores were higher in the older age group (41+ years of age).

### *Using normative data*

As an example of how to use the normative data, a psychologist completed the BPI-S on an adult with ID. On the ADB subscale, the individual had a product score of 15, which when the psychologist looked at mean subscales product scores in Table II (row 4 – “Mean BPI-S Subscale score,” column 3 from the left – “ADB”) was higher than the mean population norm of 2.76. The highest rated behavior was item No. 9 “Hitting others,” where the individual was rated as displaying this weekly and severely. Looking in Table I (row – item 9 “Hitting others,” column’s 7 “weekly” and 12 “severe”), the psychologist noted although 20 percent of adults with ID do present with this behavior, just 3.77 percent display it weekly and only 1.13 percent display at a severe level, suggesting that “Hitting others” may be a behavior requiring prompt intervention for this person.

In another example, a regional care provider completed the BPI-S on 40 adults with ID across 17 residential settings. A prevalence rate of SIB (at least one item rated within the SIB subscale at any frequency/severity) of 37.5 percent was discovered which was higher than the 24.15 percent norm provided in Table II (row 3 “prevalence of at least one behavior,” column 2 “SIB”). Other aggressive and stereotypical behaviors were closer to the listed norms. As a result, the provider ensured everyone engaging in SIB was prioritised for a functional behavioral assessment. When making clinical decisions about target behaviors for intervention, the normative data should be considered alongside risk concerns and the potential impact on the individual’s quality of life.

## BPI-S clinically significant change scores

At the individual level, a key question in relation to intervention is whether the person’s problems have changed sufficiently that he or she might be considered no longer to “have” that problem. This is a critical issue in services, and an area of interest to researchers.

Jacobson and Truax (1991) proposed that clinically significant change following intervention is best operationalised as moving outside the mean range of the “dysfunctional” population (in this case, the population who have challenging behavior) to within the mean range of the “functional” population (in this case, those without challenging behavior).

**Table 1** Endorsement of BPI-S items in the Jersey adult administrative ID population (*n*, %)

Subscale and items	Never a problem ( <i>n</i> )	Problem ( <i>n</i> )	Problem (%)	Frequency of occurrence (%)				Severity of the problem (%)		
				Monthly	Weekly	Daily	Hourly	Mild	Moderate	Severe
<i>Self-injurious behavior</i>										
1. Self-biting	250	15	5.66	1.89	3.02	0.75	0	3.02	2.64	0
2. Head hitting	242	23	8.68	3.40	2.64	2.64	0	4.53	3.02	1.13
3. Body hitting	248	17	6.42	2.26	1.89	2.26	0	3.77	2.26	0.38
4. Self-scratching	236	29	10.94	4.53	3.02	2.64	0.75	4.15	4.91	1.89
5. Pica	256	9	3.4	1.89	0.38	1.13	0	1.51	1.13	0.75
6. Inserting objects	262	3	1.13	0.38	0.38	0.38	0	0.75	0.38	0
7. Hair pulling	256	9	3.4	1.13	0.38	1.89	0	0.38	1.89	1.13
8. Teeth grinding	248	17	6.42	1.51	0.38	2.64	1.89	4.53	0.75	1.13
<i>Aggressive/Destructive behavior</i>										
9. Hitting others	211	54	20.38	15.09	3.77	1.51	0	9.81	9.43	1.13
10. Kicking others	246	19	7.17	6.04	0.75	0.38	0	3.40	3.02	0.75
11. Pushing others	223	42	15.85	13.21	1.13	1.51	0	10.94	4.15	0.75
12. Biting others	259	6	2.26	2.26	0	0	0	0.75	1.13	0.38
13. Grabbing and pulling others	230	35	13.21	8.30	2.26	2.64	0	7.55	4.91	0.75
14. Scratching others	255	10	3.77	2.26	0	1.51	0	1.51	2.26	0
15. Pinching others	252	13	4.91	3.02	1.51	0.38	0	2.64	1.89	0.38
16. Verbally abusive with others	202	63	23.77	12.83	6.79	3.40	0.75	15.85	6.42	1.51
17. Destroying things	217	48	18.11	11.70	5.28	0.75	0.38	8.30	8.68	1.13
18. Bullying – being mean or cruel	244	21	7.92	3.77	1.89	2.26	0	4.91	2.64	0.38
<i>Stereotyped behavior</i>										
19. Rocking, repetitive body movements	227	38	14.34	2.26	3.02	5.66	3.40			
20. Sniffing objects, own body	252	13	4.91	1.13	0.75	2.26	0.75			
21. Waving or shaking arms	235	30	11.32	2.26	2.26	4.15	2.64			
22. Manipulating objects	240	25	9.43	2.26	0.38	5.28	1.51			
23. Repetitive hand and/or finger movements	230	35	13.21	1.13	2.26	4.15	5.66			
24. Yelling and screaming	221	44	16.6	5.28	4.53	4.15	2.64			
25. Pacing, jumping, bouncing, running	229	36	13.58	4.15	3.02	3.77	2.64			
26. Rubbing self	239	26	9.81	1.89	1.51	4.15	2.26			
27. Gazing at hands or objects	235	30	11.32	2.26	3.02	3.77	2.26			
28. Bizarre body postures	253	12	4.53	0.75	1.89	1.89	1.13			
29. Clapping hands	250	15	5.66	0.75	1.89	1.89	1.13			
30. Grimacing	235	30	11.32	1.89	2.64	5.28	1.51			

**Table II** Descriptive BPI-S Scale statistics

Items	SIB	ADB	SB	BPI-S total
Prevalence of at least one behavior ( <i>n</i> )	64	109	99	155
Prevalence of at least one behavior (%)	24.15	41.13	37.36	58.49
Median BPI-S subscale score	0	0	0	2
Mean BPI-S subscale score (SD) <sup>a</sup>	1.59 (4.18)	2.76 (5.52)	3.28 (6.59)	7.63 (12.83)
Range	30	36	45	84
Min	0	0	0	0
Max	30	36	45	84
Variance	17.5	30.46	43.40	164.70
Skewness (SE)	3.87 (0.150)	2.97 (0.150)	2.99 (0.150)	2.61 (0.150)
Male mean (SD)	2.00 (5.01)	3.40 (5.30)	4.13 (7.71)	9.54 (14.55)
Female mean (SD)	1.18 (3.09)	2.10 (5.68)	2.40 (5.07)	5.67 (10.50)
18-40 years mean (SD)	1.43 (3.73)	2.80 (5.68)	3.52 (6.83)	7.74 (13.25)
41+ years (SD)	1.75 (4.60)	2.72 (5.37)	3.04 (6.36)	7.59 (12.46)

**Notes:** <sup>a</sup>(SIB and AD = Sum of Freq x Sev scores; Stereo = Freqsum; BPI-S total = Sum of SIB, AD, SB subscales)

In a previous study (Bowring *et al.*, 2017), we identified the “dysfunctional” population (those with challenging behavior) and the “functional” population (those without). Challenging behavior was defined thus:

1. SIB: any item of SIB is “challenging” if either it is rated as severe and occurs at least weekly, or is rated as moderate but occurs at least daily. Any other occurrence of behavior is not rated as challenging.
2. ADB: any item of ADB is “challenging” if either it is rated as severe and occurs at least weekly, or is rated as moderate but occurs at least daily. Any other occurrence of behavior is not rated as challenging.
3. SB: any item of SB is “challenging” if it occurs at the highest rated frequency (hourly). Any other occurrence of behavior is not rated as challenging.
4. CB: overall challenging behavior is defined by the presence of a least one behavior defined as “challenging” in the above categories.

Using this definition, the mean scores on the BPI-S were initially estimated for the “functional” (no defined challenging behavior) and “dysfunctional” (defined challenging behavior) populations, respectively. When population means are available, as in the present study, Jacobson and Truax (1991) suggested the following equation for determining a clinical cut-off score:

$$C = S_0M_1 + S_1M_0/S_0 + S_1$$

where *S* represents the standard deviation, *M* the mean, and 0 or 1 indicate the non-challenging behavior population and the challenging behavior population.

Using this formula (method c in Jacobson and Truax, 1991), the estimated cut-off product scores were 1.88 for SIB, 5.69 for ADB, 5.66 for SB, and 9.35 for BPI-S total. The cut-off point is the score that would need to be crossed following intervention (for challenging behavior) to be classified as altered to a clinically significant degree.

#### **How to use clinically significant change scores**

As an example, an adult who attends a local authority day service engages in challenging behavior and the BPI-S ADB subscale product score is 16. If a function-based intervention was implemented for specific challenging behaviors, a BPI-S ADB post-intervention product score of 5.69 or below would be needed (see paragraph above) for that individual to be deemed as falling within the range of the non-CB population.

## BPI-S RC scores

Clinically significant change should be considered in the context of the statistical reliability of pre-to-post behavior change (Jacobson and Truax, 1991). Both are likely to contribute to an evaluation of the meaningfulness of change in terms of impact on everyday life.

RC is the amount by which an outcome needs to change before it can be 95 percent certain that the change is not due to score variability or measurement error. Jacobson and Truax (1991) indicated that for a change to be reliable (RC), the amount of change needs to be larger than  $1.96 \times \text{SE}_{\text{diff}}$ , where  $\text{SE}_{\text{diff}}$  is the standard error of the pre-post difference. The latter is estimated by:

$$\text{SE}_{\text{diff}} = \text{SD}_1 \sqrt{2\sqrt{1-r}}$$

Where  $\text{SD}_1$  is the standard deviation of the pre-test score and  $r$  is the reliability of the measure.

Change exceeding 1.96 times this  $\text{SE}_{\text{diff}}$  is likely to occur less than 5 percent of the time by unreliability of the measure alone. RC scores were calculated for every BPI-S subscale and total BPI-S scores in two ways. First, RC scores were calculated on the total population sample ( $n = 265$ ). This RC value will be a useful comparative figure for researchers or practitioners studying behavior change in population samples. Second, an RC score for individuals scoring 1+ on the BPI-S ( $n = 155$ ) was calculated. This second RC value will provide a useful comparative figure for researchers or practitioners studying behavior change in individuals/groups who already present with some problem behavior (e.g. those likely to have been referred for positive behavioral support (PBS)/challenging behavior services). As a measure of reliability (which is required in the formula above), we used each scale's internal consistency coefficient from Bowring *et al.* (2017). Results are presented in Table III.

Given the higher mean scores and SD, the RC values for the problem behavior (1+) scorers are more conservative. In this group, change in total BPI-S score of 10.37 would indicate RC, as would 8.35 in SB, 7.35 in SIB and 6.26 in ADB total. The RC values from the total population sample are 5.30 for BPI-S total, 4.87 for SIB, 6.66 for SB, and 4.50 for ADB.

### How to use RC scores

As an example of how to use these RC scores, a housing provider monitored all residents' challenging behavior utilising the BPI-S on an annual basis. The majority of their population displayed no challenging behavior so they utilised RC scores for a total population sample (Table III). One adult was supported in a single-occupancy independent living arrangement. The provider had completed the BPI-S rating scale, which gave a SIB product score of 4. Following a change in

**Table III** Reliable change scores

BPI-S scale	Mean	Range	SD	Cronbach's $\alpha$	RC score
<i>Reliable change scores – total population sample (n = 265)</i>					
SIB Freq	0.95	0-16	2.351	0.681	3.68
SIB Sev	0.76	0-10	1.759	0.627	2.98
SIB total	1.59	0-30	4.183	0.824	4.87
ADB Freq	1.73	0-18	3.112	0.792	3.97
ADB Sev	1.76	0-15	3.030	0.788	3.86
ADB total	2.76	0-36	5.519	0.893	4.50
SB Freq	3.28	0-45	6.588	0.867	6.66
BPI-S total	7.63	0-84	12.833	0.915	5.30
<i>Reliable change scores – problem behavior sample: 1+ scorers (n = 155)</i>					
SIB Freq	3.92	1-16	3.363	0.681	5.27
SIB Sev	3.14	1-10	2.315	0.627	3.92
SIB total	6.59	1-30	6.311	0.824	7.35
ADB Freq	4.20	1-18	3.631	0.792	4.59
ADB Sev	4.28	1-15	3.397	0.788	4.33
ADB total	6.71	1-36	6.909	0.893	6.26
SB Freq	8.77	1-45	8.262	0.867	8.35
BPI-S total	13.04	1-84	14.537	0.915	10.37

accommodation and a move into alternate congregate care provision the provider repeated the measure 12 months later and discovered the BPI-S SIB product score was 10 – an increase of 6. The provider looked in Table III, and using the RC score for population samples, noted that the SIB RC score was 4.87 (top part of table for total population samples, row 5 “SIB Total,” last column on right “RC Score”), indicating statistically significant deterioration in SIB for this individual. This alerted the housing provider to an issue following the move and an urgent case review was held.

As a second example, a PBS practitioner received a referral for an individual who engaged in stereotypy and for whom a score of 21 was obtained on the BPI-S SB subscale at baseline. Following a functional-based intervention, the BPI-S assessment was repeated ten months later, and the score obtained was 4. The PBS practitioner looked in Table III, for services focusing on people with some problem behavior (1+ scorers), and noted the RC score for stereotypy is 8.35 (lower part of table for 1+ scores, row 18 “SB Freq,” last column on right “RC Score”). In this case, a reduction of 17 is greater than the RC score of 8.35 demonstrating statistically reliable improvement of behavior. The PBS practitioner also found that the individual’s post-intervention score of 4 was below the 5.66 cut-off score for the stereotypy scale, demonstrating clinically significant as well as reliable behavior change.

Data collected as part of the routine practice of function-based interventions should still inform decision making. Utilising the BPI-S alongside other data allows a more robust evaluation that enables clinically significant and RC to be determined. Services should additionally consider risk and quality of life impacts of remaining behavior prior to closing cases.

## Limitations

A significant limitation of the data is the level of skewness (see Table II). Positively skewed data are common in problem behavior rating scales (Rojahn *et al.*, 2012a), even in total population samples. This means that score distributions are more likely to violate assumptions of normality and potentially distort calculations of cut-off points and RC (Connell *et al.*, 2007; Martinovich *et al.*, 1996). The distribution is determined by the characteristic being measured, and in the case of behavior problems or even challenging behavior the majority of participants will present little or no challenging behavior. It is unclear how robust the formulae given by Jacobson and Truax (1991) are for non-normally distributed data and how well cut-off scores and RC are estimated (Evans *et al.*, 1998).

The concept of “return to normality,” that is the underlying assumption of the Jacobson and Truax’s (1991) method for establishing clinically significant change, has also been criticised as not relevant to all contexts. While it may reflect the perspective of individuals with transient situational increases in challenging behavior, it may be less helpful for those whose challenging behavior is more chronic and persistent (Wise, 2004).

## Conclusions

The BPI-S is a psychometrically sound informant-based rating scale designed to assess the occurrence and severity of challenging behavior shown by individuals with ID. In this paper, population norms were provided for this measure. An extended definition of challenging behavior based on BPI-S scores was used to calculate clinically significant cut-off and RC scores. Examples provided throughout the paper show how the BPI-S can be used to facilitate clinical decisions about behavior change. The main strength of our approach is using data from a total population sample of adults with ID. This paper further develops the BPI-S as a helpful tool to evaluate intervention effects objectively for individuals and populations.

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