

Towards data based clinical decision making for adults with challenging behaviour using the Behavior Problems Inventory – Short Form (BPI-S)

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Abstract

Purpose

The Behavior Problems Inventory – Short Form (BPI-S) is a shorter version of the Behavior Problems Inventory - 01 (BPI-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 behaviour change, this paper describes how to use BPI-S clinically significant and reliable change scores.

Design/Methodology/Approach

Data were gathered on 265 adults with ID known to services. Proxy informants completed the BPI-S on challenging behaviours over the previous 6 months. Clinically significant cut off values and reliable change scores were calculated using the Jacobson and Truax (1991) method.

Findings

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

Practical Implications

Behaviour 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 behaviour 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, intellectual disability, Behavior Problems Inventory, normative data, reliable change.

Introduction

Recent population studies reveal a consistently high prevalence of challenging behaviour in individuals with intellectual disabilities (ID): Prevalence estimates range from 18.1% (Bowring *et al.* 2017) to 22.5% (Jones *et al.* 2008). Given time and resource pressures, assessment of challenging behaviour in this population is often undertaken using proxy reported standard behaviour rating scales instead of direct behaviour observation. Behaviour 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 behaviour change.

The Behaviour Problems Inventory – short form (BPI-S) is one such instrument. It assesses three of the most common challenging behaviour topographies shown by individuals with ID: aggressive-destructive, self-injurious and stereotyped behaviours (Rojahn *et al.* 2012a). The BPI-S is a standardised and reliable rating scale, with evidence of acceptable validity to assess challenging behaviour 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 behaviour 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 behaviour. Population norms may be useful to challenging behaviour 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 behaviour 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 behaviour and also specialist challenging behaviour services (McGill and Poynter, 2012). Outcome assessments are needed that can be used in regular clinical practice to show whether the amount of behaviour 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 behaviour 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 criteria for the BPI-S.

Source of BPI-S data

BPI-S data were gathered from 265 persons ≥ 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% 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 Behavior Problems Inventory - Short Form

The BPI-S comprises 30 items across three subscales: Self Injurious Behaviour [SIB] ($n=8$), Aggressive Destructive Behaviour [ADB] ($n=10$), and Stereotyped Behaviour [SB] ($n=12$). The BPI-S measures behaviours 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 behaviour 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 behaviour rated as severe represents damage to the individual or others, requiring medical intervention, or causing damage to items beyond repair. Frequency and severity of behaviour 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 1). The overall prevalence of participants presenting at least one item behaviour within each subscale was calculated (n , %), alongside the median, mean, standard deviation, range and variance of the BPI-S subscale and total scores (Table 2). Norms are

provided separately for men and women, and for younger (18-40 years of age) and older (41+) adults (median sample age was 40 years).

***INSERT TABLE 1**

Table 2 indicates that 41.13% of participants presented at least one behaviour listed within the ADB subscale, 37.36% presented with at least one behaviour in the SB subscale, and 24.15% for the SIB subscale. Overall, 58.49% of participants presented with behaviour leading to the endorsement of at least one item in the BPI-S. Median BPI-S scores in the three subscales were zero given the majority of participants did not present with a listed item behaviour. Mean BPI-S product scores in each subscale were 3.28 for SB (SD =6.59), 2.76 for ADB (SD=5.52), 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 scale. SIB product scores were higher in the older age group (41+years).

INSERT TABLE 2

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 on table 2 (row four – “Mean BPI-S Subscale score”, column three from the left – “ADB”) was higher

than the mean population norm of 2.76. The highest rated behaviour was item #9 'Hitting others' where the individual was rated as displaying this weekly and severely. Looking at table 1 (row – item 9 “Hitting others”, column’s 7 “weekly” and 12 “severe”), the psychologist noted although 20% of adults with ID do present with this behaviour, just 3.77% display it weekly and only 1.13% display at a severe level, suggesting 'Hitting others' may be a behaviour 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% was discovered which was higher than the 24.15% norm provided in Table 2 (row 3 “prevalence of at least one behaviour”, column 2 “SIB”). Other aggressive and stereotypical behaviours were closer to the listed norms. As a result, the provider ensured everyone engaging in SIB was prioritised for a functional behavioural assessment. When making clinical decisions about target behaviours 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) propose 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 behaviour) to within the mean range of the “functional” population (in this case, those without challenging behaviour).

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

- a) SIB: any item of self-injurious behaviour 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 behaviour is not rated as challenging.
- b) ADB: any item of aggressive destructive behaviour 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 behaviour is not rated as challenging.
- c) SB: any item of stereotyped behaviour is “challenging” if it occurs at the highest rated frequency (hourly). Any other occurrence of behaviour is not rated as challenging.
- d) CB: Overall challenging behaviour is defined by the presence of a least one behaviour 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 behaviour) and “dysfunctional” (defined challenging behaviour) populations, respectively. When population means are available, as in the present study, Jacobson and Truax (1991) suggest the following equation for determining a clinical cut-off score:

$$C = \frac{S_0 M_1 + S_1 M_0}{S_0 + S_1}$$

(where S represents the standard deviation, M the mean, and 0 or 1 indicate the non-challenging behaviour population and the challenging behaviour population).

Using this formula (method c in Jacobson & 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 behaviour) 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 behaviour and the BPI-S ADB subscale product score is 16. If a function-based intervention was implemented for specific challenging behaviours, 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 Reliable change scores

Clinically significant change should be considered in the context of the statistical reliability of pre-to-post behaviour 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.

Reliable change (RC) is the amount by which an outcome needs to change before it can be 95% certain that the change is not due to score variability or measurement error. Jacobson and Truax (1991) indicate that for a change to be reliable (Reliable

Change, i.e., RC), the amount of change needs to be larger than $1.96 \cdot SE_{diff}$, where SE_{diff} is the standard error of the pre-post difference. The latter is estimated by:

$$SE_{diff} = SD_1 \sqrt{2\sqrt{1-r}}$$

(where 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 SE_{diff} is likely to occur less than 5% 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 behaviour 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 behaviour change in individuals / groups who already present with some problem behaviour (e.g., those likely to have been referred for Positive Behavioural Support (PBS) / Challenging Behaviour 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 3.

INSERT TABLE 3

Given the higher mean scores and SD, the RC values for the problem behaviour (1+) scorers are more conservative. In this group, change in total BPI-S score of 10.37 would indicate reliable change, 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 Reliable Change scores

As an example of how to use these RC scores, a housing provider monitored all residents' challenging behaviour utilising the BPI-S on an annual basis. The majority of their population displayed no challenging behaviour so they utilised RC scores for a total population sample (Table 3). 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 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 at Table 3, 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 self-injurious behaviour 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 10 months later, and the score obtained was 4. The PBS practitioner looked at Table 3, for services focusing on people with some problem behaviour (1+ scorers), and noted the RC score for stereotypy is 8.35 (lower part of table for 1+ scorers, 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 behaviour. 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 behaviour 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 reliable change to be determined. Services should additionally consider risk and quality of life impacts of remaining behaviour prior to closing cases.

Limitations

A significant limitation of the data is the level of skewness (see Table 2). Positively skewed data are common in problem behaviour 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 behaviour problems or even challenging behaviour the majority of participants will present little or no challenging behaviour. 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 (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 behaviour, it may be

less helpful for those whose challenging behaviour 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 behaviour shown by individuals with ID. In this paper, population norms were provided for this measure. An extended definition of challenging behaviour based on BPI-S scores was used to calculate clinically significant cut-off and reliable change scores. Examples provided throughout the paper show how the BPI-S can be used to facilitate clinical decisions about behaviour 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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Table 1. Endorsement of BPI-S items in the Jersey adult administrative ID population (n, %)

Subscale & Items		Frequency of occurrence (%)							Severity of the problem (%)		
		Never a problem (n)	Problem (n)	Problem (%)	Monthly	Weekly	Daily	Hourly	Mild	Moderate	Severe
Self-Injurious Behaviour											
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
Aggressive/Destructive Behaviour											
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
Stereotyped Behaviour											
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	0.75	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 2. Descriptive BPI-S Scale statistics

Items	SIB	ADB	SB	BPI-S Total
Prevalence of at least one behaviour (n)	64	109	99	155
Prevalence of at least one behaviour (%)	24.15	41.13	37.36	58.49
Median BPI-S subscale score	0	0	0	2
Mean BPI-S subscale score (SD) ¹	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 (.150)	2.97 (.150)	2.99 (.150)	2.61 (.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)

¹(SIB & AD = Sum of Freq*Sev scores; Stereo = Freqsum; BPI-S Total = Sum of SIB, AD, SB subscales)

Table 3. Reliable Change scores

Reliable Change Scores – total population sample (n=265)					
BPI-S Scale	Mean	Range	SD	Cronbach's Alpha	RC Score
<i>SIB Freq</i>	.95	0-16	2.351	.681	3.68
<i>SIB Sev</i>	.76	0-10	1.759	.627	2.98
<i>SIB Total</i>	1.59	0-30	4.183	.824	4.87
<i>ADB Freq</i>	1.73	0-18	3.112	.792	3.97
<i>ADB Sev</i>	1.76	0-15	3.030	.788	3.86
<i>ADB Total</i>	2.76	0-36	5.519	.893	4.50
<i>SB Freq</i>	3.28	0-45	6.588	.867	6.66
<i>BPI-S Total</i>	7.63	0-84	12.833	.915	5.30
Reliable Change Scores – Problem behaviour sample: 1+ scorers (n=155)					
<i>SIB Freq</i>	3.92	1-16	3.363	.681	5.27
<i>SIB Sev</i>	3.14	1-10	2.315	.627	3.92
<i>SIB Total</i>	6.59	1-30	6.311	.824	7.35
<i>ADB Freq</i>	4.20	1-18	3.631	.792	4.59
<i>ADB Sev</i>	4.28	1-15	3.397	.788	4.33
<i>ADB Total</i>	6.71	1-36	6.909	.893	6.26
<i>SB Freq</i>	8.77	1-45	8.262	.867	8.35
<i>BPI-S Total</i>	13.04	1-84	14.537	.915	10.37