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Psychometric properties of the Neuropsychiatric Inventory for adults with intellectual disability

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Abstract

Background: Problem behaviours are common among people with intellectual disabilities (ID), but psychometrically evaluated instruments for assessing such behaviours are scarce. The present study evaluated the psychometric properties of the Neuropsychiatric Inventory—Intellectual Disability (NPI-ID).

Method: We assessed 108 residents with intellectual disabilities living in group-homes using the NPI-ID, which included the 12 symptoms of the original NPI-Nursing Home and two supplementary symptoms: self-injurious behaviour and impulsive risk-taking behaviour.

Results: The NPI-ID showed adequate internal consistency (α = 0.76) and test–re-test reliability (intraclass correlation coefficient = 0.88). Exploratory factor analysis revealed five factors accounting for 64.1% of the variance. Cluster analysis revealed that residents were clustered in three groups with distinctly different symptom profiles.

Conclusions: The psychometric properties were satisfactory, supporting the use of the NPI-ID as a screening tool for people with intellectual disabilities. Additional research is needed to further evaluate the utility of the NPI-ID among people with intellectual disabilities.

KEYWORDS

assessment, challenging behaviour, cognitive dysfunction, learning disability, mental retardation, psychiatric symptoms

1 | INTRODUCTION

Previous research has revealed that a relatively large proportion of people with intellectual disabilities (ID) are at risk of developing problem behaviours (Hemmings, Gravestock, Pickard, & Bouras, 2006), such as self-injury, aggression towards others, screaming, inappropriate social conduct and destructiveness (Holden & Gitlesen, 2003; Lundqvist, 2013; Rojahn, Matson, Naglieri, & Mayville, 2004). A review by Emerson et al. (2001) found that problem behaviours were reported in 10%–15% of people with intellectual disabilities who used institutional services and support. The prevalence of problem behaviours may, however, be much higher among people with more severe intellectual disabilities and those with multiple diagnoses (Deb, Thomas, & Bright, 2001; Poppes, Van der Putten,

& Vlaskamp, 2010). There is ample evidence for an association between psychiatric morbidities and problem behaviour (Axmon, Björne, Nylander, & Ahlström, 2017; Hemmings et al., 2006; Holden & Gitlesen, 2003). Problem behaviour may be a functional response to a situation where an individual's living situation breaks down due to events occurring in the social environment (Emerson, 2001).

Psychiatric morbidity and problem behaviours can seriously impede social interaction and participation in everyday activities (Rojahn et al., 2004), having a negative effect on the individual´s health and well-being (Einfeld, Ellis, & Emerson, 2011) and quality of life (Gerber et al., 2011; Lloyd & Kennedy, 2014). Furthermore, psychiatric morbidity and problem behaviours can present a significant challenge to staff in community-based services (Holden & Gitlesen, 2003), associated with an increased service cost (Emerson, 2001). Thus, decreasing psychiatric morbidity and problem behaviours among people with intellectual disabilities is an important outcome on an individual, group and societal levels.

To decrease psychiatric morbidity and problem behaviours, evidence-based interventions are needed. In achieving this objective, psychometrically sound instruments are a prerequisite for reliable and valid assessments of support and service outcomes. This is particularly important when it comes to assessment instruments for the evaluation of the effects of interventions aiming to reduce the impact of psychiatric morbidities and problem behaviours on people's daily lives (Baker & Daynes, 2010; Unwin & Deb, 2008; Zarcone, Napolitano, & Valdovinos, 2008). Psychometrically evaluated instruments for assessing psychiatric symptoms of morbidity and problem behaviours are scarce, and few have been implemented in community-based services for people with intellectual disabilities (Cobigo, Morin, & Mercier, 2012; Jones, 2013; Robertson et al., 2005).

One of the most widely used instruments for screening and measuring of psychiatric morbidity and problem behaviours is the Neuropsychiatric Inventory (NPI), which exists in both a 10- and a 12-item version (Cummings, 1997; Cummings et al., 1994). The NPI has been translated into many languages and has been shown to be a reliable and valid measure (Baranzini et al., 2013; Camozzato et al., 2008; Kørner et al., 2008; Lange, Hopp, & Kang, 2004; Selbaek, Kirkevold, Sommer, & Engedal, 2008) with good concurrent validity. The NPI has been adapted to different groups and settings, such as the *Neuropsychiatric Inventory–Nursing Home version* (Cummings, 2009; Wood et al., 2000). A Swedish translation of this version was recently psychometrically evaluated (Granvik, Minthon, Nägga, Hylén, & Kumlien, 2018). Staff in nursing homes in Sweden have used the NPI for people with dementia as a structured way to screen for and evaluate problem behaviours, and to determine when intervention is warranted. In a comparative study of people with dementia, this structured approach to assessment and psychosocial interventions significantly reduced problem behaviours in the intervention group when compared to a control group (Mayer, Granvik, Minthon, & Nägga, 2014). Validated measurements are crucial for evidence-based practice (Fineout-Overholt, Melnyk, & Schultz, 2005). A brief screening measurement that targets problem behaviours and which can be used by staff in group homes for people with intellectual disabilities is needed to support evidence-based practice in this context. The NPI has been shown to work well in community settings (Mayer et al., 2014; Melander, Sävenstedt, Olsson, & Wälivaara, 2018). However, no version of the NPI has been adapted for assessing psychiatric symptoms and problem behaviour among people with intellectual disabilities. Thus, the aim of the present study was to evaluate the psychometric properties of the *Neuropsychiatric Inventory–Intellectual Disability* (NPI-ID).

2 | METHODS

The current study is a psychometric evaluation of the NPI-ID for the assessment of psychiatric symptoms and problem behaviours among adults with intellectual disabilities.

2.1 | Participants

The recruitment of participants was conducted within the Funca education programme (Funca, 2019), which has been developed in Sweden. Funca includes a web-based education programme for staff working in group homes. Thirty-seven units for people with intellectual disability (26 group homes, six daily activities centres, four habilitation units and one personal assistance unit) in 23 municipalities took part in the Funca education programme and agreed to the recruitment of their residents to participate in the present study. One to two members of staff per group home received Funca education and training in assessment with the NPI-ID. The members of staff were asked to assess, using the NPI-ID instrument, up to three residents with problem behaviour. The residents assessed by the staff all had intellectual disability, either from birth or from early childhood (American Psychiatric Association, 2013; Schalock et al., 2010). A total of 108 residents with intellectual disabilities (34 women, 63 men and 11 with gender information missing) with a mean age of 44.3 years (range 20–78 years) participated in the current study. Participants were each assessed on two occasions 1 week apart, and 56 members of staff were involved in conducting assessments (90% women, between 22 and 64 years old with a mean age of 46.3 years). Each resident was assessed by only one member of staff.

2.2 | Development of the NPI-ID

The NPI-ID is based on the original NPI-NH (Cummings, 1997), and permission to develop the NPI-ID was obtained from the creator of the NPI (J. L. Cummings). The NPI-ID includes the same 12 psychiatric symptoms and problem behaviours as the original instrument: delusions, hallucinations, agitation, depression, anxiety, euphoria, apathy, disinhibition, irritability, aberrant motor behaviour, sleep disorders and eating disorders. However, based on a review of the

literature concerning problem behaviours in people with intellectual disabilities and interviews with group home staff, two supplementary questions were added, including one on self-injurious behaviour and one on impulsive risk-taking behaviour, defined as behaviours harmful to health and safety made without considering the consequences (Ahlström, Kulneff, & Granvik, 2016). Thus, the NPI-ID consisted of 14 psychiatric symptoms and problem behaviours, which, for the sake of readability, will be referred to as "symptoms" in this text.

To increase the content validity of the NPI-ID, an unscored item "Other symptoms" was added, giving the staff the opportunity to report any symptom they felt was missing. In addition, a few minor adjustments were made to the response options. A revised manual has been produced for the NPI-ID (Ahlström et al., 2016). A pilot test of the NPI-ID was carried out at 10 group homes for people with intellectual disabilities in the spring of 2016, and this did not give rise to any changes in the NPI-ID.

As in the original NPI (Cummings, 2009), the questions in the NPI-ID concerning each symptom require a "Yes" or "No" answer (symptom present or absent). An affirmative answer is followed up with five to eight sub-questions, also requiring a "Yes" or "No" answer. The frequency of the symptoms and the degree of severity are then rated. The possible scores for frequency are 0 (Never), 1 (Sometimes), 2 (Quite often), 3 (Often) and 4 (Very often). The possible scores for severity are 0 (Not applicable), 1 (Mild), 2 (Moderate) and 3 (Severe). The score for frequency is multiplied by the score for severity into a composite score, which means that each symptom can score a maximum of 12 points, giving a maximum of 168 for the NPI-ID composite score of the 14 psychiatric symptoms and problem behaviours (Ahlström et al., 2016).

2.3 | Data collection

Members of staff who had completed the Funca education programme were given information about the purpose and design of the study and were then asked to carry out assessments of participating residents using the NPI-ID. Those who agreed to this involvement gave both oral and written consent. Thereafter, the staff distributed information letters and consent forms to the residents with intellectual disability, or, where necessary, to the resident's next of kin or authorized representative. Both the information letter and the consent form were presented in an easy-to-read format. Consent implied giving permission for anonymized assessment by the member of staff to be used as data in this study.

When written consent had been obtained from the residents with intellectual disability, next of kin or an authorized representative, the member of staff filled in the assessment form and sent it immediately to the responsible researcher (GA). One week later, the assessment was repeated by the same member of staff. Each member of staff could assess a maximum of three residents with i*ntellectual disabilities*. In addition, they were instructed to continue with the treatment as usual for those who had psychiatric symptoms or problem behaviours during the week between the first and the second assessment. The participating residents with i*ntellectual disabilities* did not answer any of the questions.

2.4 | Psychometric testing of the NPI–ID

Data were analysed using IBM SPSS Statistics for Windows, version 22 (IBM Corp.). Internal consistency was evaluated using Cronbach's alpha (Cronbach, 1951). A Cronbach's α value above 0.7 was considered satisfactory (Nunnally & Bernstein, 1994). Pearson's correlation coefficients were used between NPI-ID symptoms at Assessment 1 and at Assessment 2, respectively. Correlations of 0.10–0.29 were considered small, those of 0.30–0.49 were considered moderate, and those of 0.5 or above were considered large (Cohen, 1988). The McNemar test was used for analysing repeated nominal data. The Kaiser–Mayer–Olin test and Bartlett's test of sphericity were used to evaluate the sampling adequacy of the data. Exploratory factor analysis employing the principal component model and Promax rotation was performed on the 14 NPI-ID symptoms (Table 1). The "Other symptom" item was not included in the factor analysis since it does not measure any specific symptom. The number of factors was determined as all factors with an eigenvalue greater than 1. To identify how the individuals were grouped with respect to symptomatology, K-means cluster analysis was performed. All the analyses were performed on the multiplicative frequency by severity (FxS) composite score for the particular symptom and for the total composite sum score. A *p*-value of .05 or smaller was considered statistically significant.

2.5 | Ethical aspects

The study was approved by the Regional Ethical Review Board in Lund (2016/713) and was conducted in accordance with the ethical guidelines of the Helsinki Declaration. Staff members working within the framework of the intellectual disability service were given oral and written information about the study and a clarification of what was implied by confidentiality. They were informed that providing assessments with NPI-ID was voluntary and that they could cease their involvement at any time without specifying a reason. The participating residents were given oral and, if possible, written information by the staff before giving consent is to be assessed. The researcher informed the staff about the obligation to apply the principle of non-maleficence when working with a person with a disability, meaning that no negative consequences or harm to the person were allowed to result from their participation in the study. Consent was given by the persons with intellectual disabilities or, where necessary, by their next of kin or authorized representatives. The residents, their next of kin or authorized representatives and the staff performing the assessments were informed that the data collected would be coded and kept in a locked and fireproof cabinet which only the responsible

TABLE 1 Prevalence of symptoms and frequency by severity (FxS) sum scores among people with intellectual disabilities living in group homes

	Assessment 1				Assessment 2			
Symptom	Prevalence *n* (%)	Frequency mean (*SD*)	Severity mean (*SD*)	FxS sum score mean (*SD*)	Prevalence *n* (%)	Frequency mean (*SD*)	Severity mean (*SD*)	FxS sum score mean (*SD*)
Delusions	26 (24)	2.04 (0.92)	1.69 (0.62)	3.62 (2.42)	21 (19)	2.14 (0.96)	2.14 (0.96)	3.76 (2.10)
Hallucinations	18 (17)	2.56 (1.29)	1.83 (0.86)	5.22 (4.36)	16 (15)	2.75 (1.13)	2.75 (1.13)	5.56 (3.97)
Agitation	75 (69)	2.27 (1.18)	1.61 (0.70)	3.93 (3.09)	74 (69)	2.07 (1.04)	2.07 (1.04)	3.29 (2.63)
Depression	51 (47)	1.84 (0.97)	1.33 (0.59)	2.63 (2.14)	44 (41)	1.73 (0.97)	1.73 (0.97)	2.56 (2.43)
Anxiety	64 (59)	2.44 (1.14)	1.52 (0.69)	4.02 (3.07)	63 (58)	2.19 (1.13)	2.19 (1.13)	3.55 (3.14)
Euphoria	45 (42)	2.31 (1.02)	1.49 (0.55)	3.82 (2.68)	43 (40)	2.19 (1.05)	2.19 (1.05)	3.33 (2.38)
Apathy	29 (27)	1.97 (0.91)	1.34 (0.55)	2.72 (1.85)	25 (23)	1.88 (0.93)	1.88 (0.93)	2.60 (1.89)
Disinhibition	52 (48)	2.25 (1.15)	1.50 (0.67)	3.81 (3.19)	54 (50)	2.15 (1.05)	2.15 (1.05)	3.49 (2.98)
Irritability	68 (63)	2.49 (1.11)	1.54 (0.63)	4.16 (2.90)	71 (66)	2.30 (1.16)	2.30 (1.16)	3.83 (3.32)
Aberrant motor behaviour	47 (44)	3.06 (1.21)	1.79 (0.81)	5.77 (3.70)	49 (45)	2.90 (1.21)	2.90 (1.21)	5.31 (3.53)
Sleep disorders	29 (27)	2.62 (1.02)	1.66 (0.90)	4.79 (3.87)	28 (26)	2.46 (1.00)	2.46 (1.00)	4.39 (3.71)
Eating disorders	40 (37)	3.05 (1.09)	1.70 (0.82)	5.48 (3.53)	45 (42)	2.73 (1.20)	2.73 (1.20)	4.44 (3.10)
Self-injury	34 (32)	2.00 (1.13)	1.68 (0.84)	3.59 (3.21)	32 (30)	1.97 (1.15)	1.97 (1.15)	3.12 (2.87)
Impulsive risk behaviour	21 (19)	2.00 (1.10)	1.67 (0.73)	3.76 (3.22)	20 (19)	2.20 (1.01)	2.20 (1.01)	4.40 (3.32)
Other	11 (10)	2.82 (1.25)	1.82 (0.87)	5.27 (3.98)	8 (7)	2.14 (0.96)	2.14 (0.96)	6.63 (4.07)

Note: Mean and standard deviations are based on residents with symptoms present. Assessment 2 was conducted 1 week after assessment 1.

researcher (GA) has access to. They were also informed that the data would only be presented at a group level.

3 | RESULTS

3.1 | Descriptive

Descriptive statistics and prevalence of the symptoms measured by the NPI-ID at Assessment 1 and Assessment 2 (1 week later) are shown in Table 1. Of the 108 assessed residents, 106 had at least one symptom. The most prevalent symptoms among the residents at both Assessment 1 and Assessment 2 were agitation, followed by irritability and anxiety. However, the most frequent and most severe symptom was aberrant motor behaviour, followed by eating disorders and hallucinations, indicating that the most prevalent symptoms were not necessarily the most challenging ones. In addition, correlation analysis of the frequency and severity relationship showed that these two aspects of symptoms had a strong correlation (r = .83, p < .001).

Concerning the two symptoms specific to NPI-ID, 32% of the residents showed self-injury and 19% showed impulsive risk behaviour, in keeping with the prevalence of other symptoms present among the residents. The "Other symptoms" option in NPI-ID was reported for 11 individuals at Assessment 1 and for eight individuals at Assessment 2, of which seven were the same as at Assessment 1. The type of symptom was specified for four individuals and included obsession, drug abuse and stress-related behaviours. These symptoms were deemed not to be equivalent to any of the predefined symptoms in the NPI-ID. Due to the ideographic nature of the "Other symptom" scale, it was excluded from further analyses.

Based on the total sample (n = 108) (i.e. including those with and those without specific symptoms present), the highest composite score ratings were found for aberrant motor behaviour, followed by eating disorders and hallucinations. The results from the correlation analysis on NPI-ID symptoms at Assessment 1 and Assessment 2 are shown in Table 2. At Assessment 1, 42 (46%) of the correlation coefficients were significant, and at Assessment 2, 50 (55%) of the coefficients were significant. At Assessment 1, 51 coefficients (56%) were considered small, 15 (16%) moderate and one (1%) large. At Assessment 2, 42 coefficients (46%) were considered small, 26 (29%) moderate and five (5%) large.

3.2 | Reliability

The internal consistency was adequate for the NPI-ID at Assessment 1 and Assessment 2, with Cronbach's alpha coefficients of 0.76 and 0.80, respectively. The prevalence, frequency and severity of the symptoms were stable over time, as indicated by a test–retest reliability using an intraclass correlation coefficient of 0.88

TABLE 2 Correlation coefficients (Pearson's *r*) between NPI-ID symptoms at Assessment 1 (lower area, shaded) and at Assessment 2 (upper area, unshaded)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A: Delusions	1	0.37***	0.04	0.20*	0.36***	0.22*	0.31**	0.22*	0.22*	0.13	0.25**	0.30***	0.12	0.33***
B: Hallucinations	0.45***	1	0.23*	0.12	0.09	0.05	0.15	0.02	0.11	0.05	0.14	0.18	0.06	0.02
C: Agitation	0.09	0.18	1	0.45***	0.39***	0.16	0.02	0.35***	0.64***	0.16	0.37***	0.04	0.24*	0.25**
D: Depression	0.19*	0.17	0.27**	1	0.55***	0.01	0.14	0.20*	0.46***	0.16	0.50***	0.12	0.10	0.38***
E: Anxiety	0.22*	0.09	0.24*	0.35***	1	0.14	0.02	0.38***	0.29***	0.14	0.56***	0.11	0.24*	0.24*
F: Euphoria	0.28**	0.16	0.24*	−0.00	0.20*	1	0.18	0.26**	0.26**	0.30**	0.07	0.32***	−0.04	0.20*
G: Apathy	0.18	0.12	0.07	0.15	0.19*	0.16	1	0.25**	0.13	0.19	0.26**	0.34***	0.04	0.21*
H: Disinhibition	0.08	−0.03	0.40***	0.08	0.27**	0.24*	0.17	1	0.54***	0.38***	0.37***	0.26**	0.44***	0.43***
I: Irritability	0.24*	0.08	0.57***	0.25**	0.26**	0.39***	0.13	0.39***	1	0.25*	0.41***	0.09	0.34***	0.35***
J: Aberrant motor behaviour	0.02	0.00	0.20*	−0.15	0.08	0.24*	0.09	0.46***	0.19*	1	0.12	0.14	0.34***	0.09
K: Sleep disorders	0.19*	0.11	0.33***	0.33***	0.26**	0.01	0.27**	0.25**	0.34***	0.06	1	0.30**	0.21*	0.40***
L: Eating disorders	0.24**	0.23*	0.12	0.05	0.19	0.34***	0.24*	0.18	0.19*	0.15	0.09	1	0.03	0.36***
M: Self-injury	0.00	0.10	0.37***	−0.05	0.33***	0.08	0.03	0.44***	0.13	0.34***	0.05	−0.05	1	0.04
N: Impulsive risk behaviour	0.18	−0.02	0.11	0.25**	0.16	0.18	0.17	0.35***	0.29**	0.19	0.18	0.17	−0.08	1

Note: Assessment 2 was conducted 1 week after assessment 1.

*$p < .05$.

**$p < .01$.

***$p < .001$.

TABLE 3 Factor analysis employing the principal components model of the NPI-ID on people with intellectual disabilities

				Factor				
Symptom	Mean	*SD*	*h*	1	2	3	4	5
M Self-injury	1.13	2.46	0.82	**0.77**	0.09	−0.05	0.10	**−0.53**
J K Aberrant motor behaviour	2.51	3.76	0.63	**0.77**	−0.25	−0.03	0.02	0.13
H Disinhibition	1.83	2.92	0.70	**0.70**	0.14	−0.15	0.20	0.23
D Depression	1.24	1.97	0.66	**−0.37**	**0.75**	0.01	0.24	0.17
K Sleep disorders	1.29	2.91	0.52	−0.01	**0.69**	−0.07	0.13	0.20
E Anxiety	2.38	3.08	0.50	0.26	**0.55**	0.14	−0.01	−0.08
B Hallucinations	0.87	2.62	0.69	−0.16	0.08	**0.82**	0.05	**−0.41**
A Delusions	0.87	1.94	0.59	−0.18	0.15	**0.75**	0.06	−0.03
L Eating disorders	2.03	3.41	0.55	0.11	−0.09	**0.58**	−0.11	0.28
F Euphoria	1.56	2.53	0.63	0.19	**−0.32**	**0.53**	**0.32**	0.22
I Irritability	2.62	3.06	0.74	0.07	0.16	0.10	**0.70**	**0.30**
C Agitation	2.73	3.15	0.73	0.23	0.23	0.03	**0.70**	−0.10
G Apathy	0.73	1.54	0.63	0.22	**0.44**	0.22	**−0.48**	0.28
N Impulsive risk behaviour	0.73	2.04	0.61	0.04	0.23	−0.10	−0.10	**0.75**
Eigenvalues				3.52	1.76	1.43	1.24	1.02
Percent variance				25.12	12.56	10.21	8.85	7.32
Cumulative percent variance				25.12	37.68	47.90	56.74	64.06

Note: SD = standard deviation, *h* = communality. Loadings > 0.30 are marked in bold. Cross loadings (i.e. a symptom with loadings that differ less than |0.20| on two or more components) are underlined.

(95% CI = 0.85–0.91). A McNemar test for repeated nominal data showed no significant change in prevalence of any symptom from Assessment 1 to Assessment 2 (all *p*-values > .10). The mean FxS composite sum scores for the symptoms were stable over time except for agitation, which decreased from a mean FxS composite score of 2.73 (*SD* = 3.15) at Assessment 1 to 2.22 (*SD* = 2.22) at Assessment 2 ($t_{(107)}$ = 2.43, *p* = .017).

3.3 | Factor structure

The Kaiser–Mayer–Olkin test produced a value of 0.70 and the Bartlett's test of sphericity with 91 degrees of freedom produced a value of 343.74 (*p* < .0001), suggesting that the use of factor analysis on the data was appropriate. Exploratory factor analysis employing the principal component model showed adequate communalities; Promax rotation of the 14 symptoms revealed five factors with eigenvalues larger than one (Table 3), explaining 64.1% of the variance. The first factor was defined by self-injury, aberrant motor behaviour and disinhibition, the second factor by depression, sleep disorders and anxiety, the third by hallucinations, delusions, eating disorders and euphoria, the fourth by irritability and agitation, and the fifth by impulsive risk behaviour. One symptom, apathy, cross-loaded on two factors, indicating that apathy was not distinct to one factor but was present concurrently with the factors defined by irritability and depression. It should be noted that apathy was negatively related to the irritability/agitation factor, indicating that irritability/agitation was associated with a lower degree of apathy.

3.4 | Cluster analysis

To elucidate the distribution of symptoms among the residents, cluster analyses were performed on the 14 symptoms of NPI-ID. A K-mean cluster analysis showed that the sample consisted of two distinct groups: one group with 70 people (Cluster 1) and a second with 38 people. Further analyses revealed that the second group consisted of two subgroups, one with 28 people (Cluster 2) and the other with 10 people (Cluster 3). A plot of the composite sum scores against the cluster belonging of each individual (Figure 1) revealed that Cluster 1 consisted of individuals with low to moderate composite sum scores and Clusters 2 and 3 of those with high composite sum scores. A one-way analysis of variance (ANOVA) with Tukey's honestly significant difference (HSD) test revealed that the composite sum score of Cluster 1 (mean = 10.99, *SD* = 8.08) was significantly lower (*p* < .001) than that of Cluster 2 (mean = 40.29, *SD* = 8.53), which was significantly lower (*p* < .001)

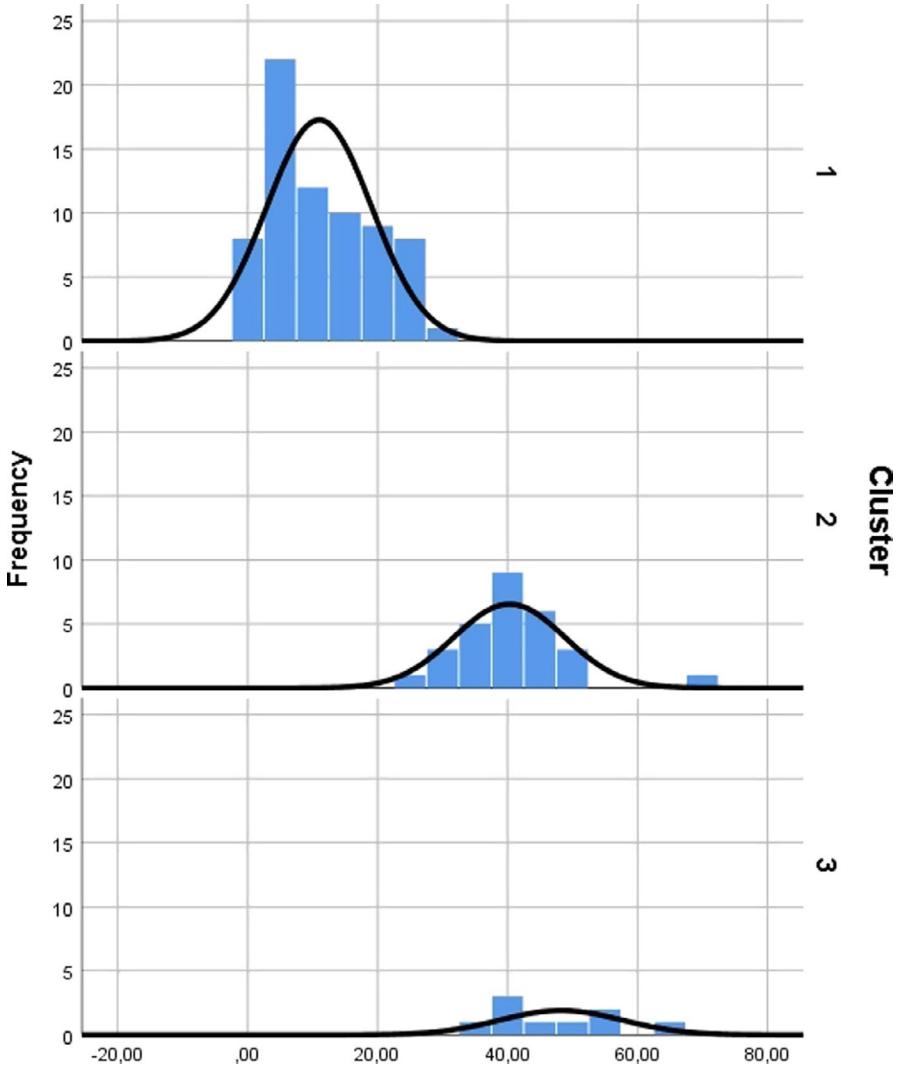

FIGURE 1 Cluster analysis of NPI-ID data of people with intellectual disabilities. FxS = frequency by severity (of symptoms)

than that of Cluster 3 (mean = 53.60, *SD* = 19.18). To investigate the symptom pattern for each cluster, a one-way ANOVA was performed with Tukey's HSD on the composite sum score of each symptom. As shown in Table 4, Cluster 3 was distinctly higher in hallucinations, disinhibition, irritability, sleep disorders and impulsive risk behaviour compared with Cluster 1 and Cluster 2, and distinctly higher in delusions and depression compared with Cluster 1. Cluster 2 was distinctly higher in eating disorders compared with Cluster 1 and Cluster 3 and distinctly higher in euphoria compared with Cluster 1. In addition, Cluster 2 and Cluster 3 were distinctly higher in agitation, anxiety, aberrant motor behaviour and self-injury compared with Cluster 1. The only symptom not significantly different across the three clusters was apathy, which was very low in all three clusters.

3.5 | Sensitivity and specificity

The receiver operating characteristic (ROC) curves for the composite sum score of the NPI-ID scale are shown in Figure 2. The area under the curve (AUC) was 0.996 ($p < .001$), with a sensitivity of 98.6% (CI 92.2%–99.9%) and a specificity of 92.3% (CI 79.1%–98.4%). A composite sum score of 27 was identified as the optimal screening cut-off score for the composite scale, with a Youden index score of 0.95. The correct classification was 96.3% (CI 90.8%–98.9%). Using the data from Assessment 2 as a validation of classification stability, the AUC was found to be somewhat lower, 0.932 ($p > .001$), the sensitivity was 88.2% (CI 78.7%–94.4%) and the specificity was 87.5% (CI 71.0%–96.5%). With a cut-off score of 27, the correct classification rate was 88.0% (CI 80.3%–93.4%) at Assessment 2.

4 | DISCUSSION

The main results of the study revealed that all symptoms measured by the NPI-ID were present among individuals with intellectual disability, the NPI-ID was internally consistent and had adequate test–retest reliability, and the 14 symptoms were expressed in five symptom domains. Moreover, the participating residents were clustered in three groups with distinctly different symptom profiles.

TABLE 4 One-way ANOVA with Tukey's HSD on FxS sum score of NPI-ID symptoms for three clusters of people with intellectual disabilities (n = 108)

	Cluster 1 n = 70	Cluster 2 n = 28	Cluster 3 n = 10
Delusions	0.54[a]	1.21[ab]	2.20[b]
Hallucinations	0.23[a]	0.70[a]	**2.53[b]**
Agitation	1.29[a]	4.93[b]	6.70[b]
Depression	0.83[a]	1.82[ab]	2.50[b]
Anxiety	1.39[a]	4.07[b]	4.60[b]
Euphoria	0.76[a]	3.39[b]	2.10[ab]
Apathy	0.57[a]	0.96[a]	1.20[a]
Disinhibition	0.57[a]	3.29[b]	**6.60[c]**
Irritability	1.34[a]	4.14[b]	**7.30[c]**
Aberrant motor behaviour	1.16[a]	4.68[b]	5.90[b]
Sleep disorders	0.61[a]	1.07[a]	**6.60[b]**
Eating disorders	1.03[a]	**4.64[b]**	1.70[a]
Self-injury	0.26[a]	2.71[b]	2.80[b]
Impulsive risk behaviour	0.41[a]	0.82[a]	**2.70[b]**
Mean FxS sum score	10.99[a]	40.29[b]	53.60[c]

Note: Means with the same superscript are not significantly different (α = 0.05) according to Tukey's HSD test. Means in bold are typical for that cluster.

FxS = frequency by severity.

4.1 | Prevalence

Consistent with previous research, most of the symptoms had a prevalence of between 20% and 50%, with few symptoms having a prevalence exceeding 50% (Camozzato et al., 2008; Cummings, 1997; Lange et al., 2004; Selbaek et al., 2008). In the present study, few of the assessing staff used the "Other symptom" option. This suggests that the NPI-ID covers most of the psychiatric symptoms and problem behaviours present in people with intellectual disability, indicating that NPI-ID had adequate content validity. In addition, the observed composite scores for the symptoms were highly stable over time, with the only exception being a decrease in agitation. As no previous studies have indicated any reason for agitation to vary more than other symptoms, this finding should be tested in other groups of people with intellectual disabilities.

4.2 | Reliability

The internal consistency of the NPI-ID overall score was somewhat lower than the alpha value of 0.88 reported for the NPI by Cummings et al. (1994) but was comparable with later studies reporting alpha values between 0.67 and 0.84 (Dechamps, Jutand, Onifade, Richard-Harston, & Bourdel-Marchasson, 2008; Lange et al., 2004; Leung, Lam, Chiu, Cummings, & Chen, 2001; Selbaek et al., 2008). Thus, the NPI-ID appeared to exhibit reasonable-to-good internal consistency. The test–retest reliability was high, thus showing that the NPI-ID is stable over time and is an adequate measure for comparisons on a group level (Fayers & Machin, 2016).

4.3 | Factor structure

The exploratory factor analysis suggested a five-factor solution, which is within the range of factors observed in other studies using the NPI. A recent review of psychometric studies on NPI found that its factor structure varied greatly, between two and 12 factors, depending on the type of population, NPI version and psychometric tests used (Lai, 2014). Although it is difficult to compare factor structures across different studies, the observed factor structure was comparable with others, to some extent. For instance, delusions and hallucinations, as well as agitation, irritability, depression and apathy loaded on similar factors, consistent with the factor structure found for elderly patients in psychiatric hospitals (Lange et al., 2004; Zuidema, de Jonghe, Verhey, & Koopmans, 2007) and patients with Alzheimer's disease (Spalletta et al., 2004).

However, one symptom, apathy, cross-loaded on two factors, indicating that apathy was related to two symptom domains, being positively related to depression and negatively related to irritability/agitation. This result is in line with previous findings regarding the features of depression in people with intellectual disabilities (Davis, Judd, & Herrman, 1997).

4.4 | NPI-ID profiles

In the present study, cluster analysis revealed three subgroups with distinctly different symptom profiles. A low-scoring group with unspecific symptomatology (Cluster 1), a multiple symptomatology group particularly defined by eating disorders (Cluster 2) and a multiple symptomatology group defined by hallucination, disinhibition, irritability, sleep disorders and impulsive risk behaviours (Cluster 3). These subgroups are to some extent consistent with NPI profile subgroups found among patients with dementia. For instance, Aarsland et al. (2007) found different clusters among patients with Parkinson's disease and dementia, where the largest group (52%) had few and mild symptoms, consistent with the Cluster 1 NPI-ID profile. Furthermore, there was a psychosis cluster (8%) with high scores on delusions and hallucinations, consistent with the Cluster 3 NPI-ID profile. Another study by Johnson, Watts, Chapin, Anderson, and Burns (2011) reported a three-factor model of psychiatric symptoms among people with different types of dementia. The Parkinson's dementia group had the lowest levels of mood, psychotic and frontal symptoms, which is consistent with the Cluster 1 NPI-ID profile, whereas the vascular dementia group exhibited the highest levels of symptoms, consistent with the Cluster 3 NPI-ID profile. The current cluster analysis results are thus in line with previous research on the NPI.

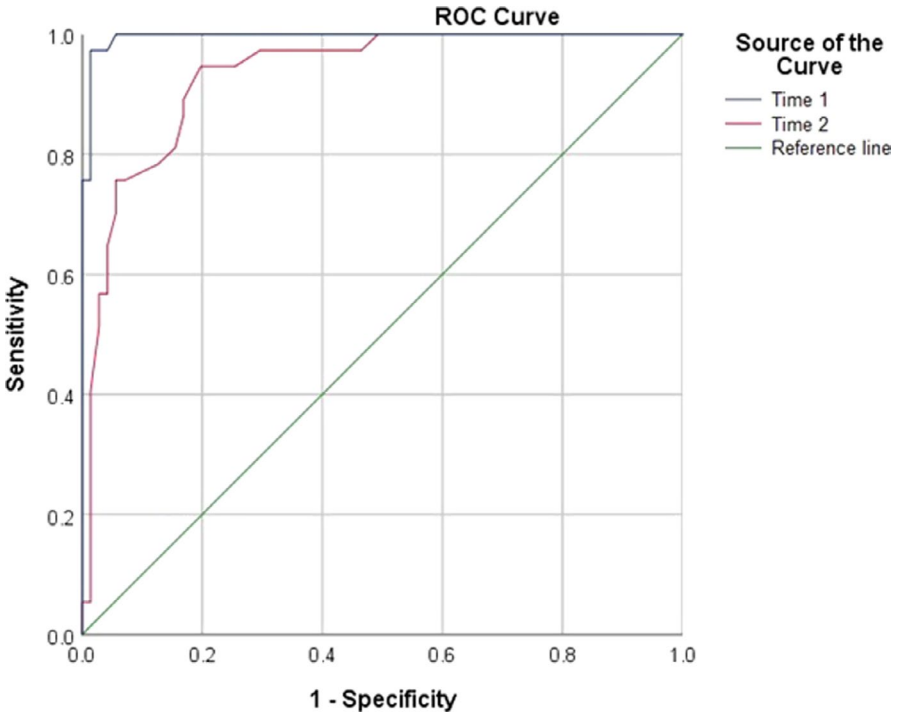

FIGURE 2 Receiver operating characteristic (ROC) curves illustrating the ability of the NPI-ID to identify individuals with challenging psychiatric symptoms and problem behaviours at alternative cut-off points at Assessment 1 and Assessment 2. Note that a perfect measure would have an AUC value of 1.0, whereas a measure with no indicative value would have an AUC value of 0.5, with the ROC curve lying on the diagonal

In the present study, the eating disorder symptom was particular to the Cluster 2 NPI-ID profile. In previous literature on intellectual disability, eating disorders such as anorexia nervosa, bulimia nervosa, hyperphagia, constant food seeking, pica and food refusal are well documented (e.g. Gravestock, 2000; Hove, 2004, 2007). Notably, eating disorders were associated with self-injury and aggression (Hove, 2007), which is consistent with the Cluster 2 NPI-ID profile. Based on a sensitivity and specificity analyses, a cut-off composite score of 27 was suggested, indicating residents with more challenging symptomatology (i.e. Clusters 2 and 3) in need of specialist examination and further specialized treatment.

Finally, the two supplementary symptoms (self-injurious behaviour and impulsive risk-taking behaviour) that were added to the NPI-ID were present in all the three clusters, particularly Clusters 2 and 3. This finding provides support for the relevance of assessing these symptoms in screening for problem behaviours among people with intellectual disabilities and thus keeping them in the NPI-ID.

4.5 | Limitations

The sample size and associated statistical power are always the issues in research. The number of participants (n = 108) in the current study was in keeping with previous studies evaluating the NPI in other groups (e.g. Selbaek et al., 2008). Although a greater number of participants may not necessarily lead to a different result, it would be expected to provide greater precision of parameter estimates. This is particularly true for rare symptom categories. A prevalence of 10 participants per symptom category is generally needed to enable reasonable evaluations (Linacre, 2002). In the present study, the lowest prevalence among the 14 symptoms at the first assessment was 18 participants for the hallucinations symptom. Thus, the general prevalence per category criterion was satisfied. However, the level of intellectual disabilities may covary with the frequency of symptoms, and, since we do not have assessments of residents' IQ scores, this would be an important question for future research.

Another limitation is that the procedure of the study did not enable evaluation of inter-rater reliability. Previous research in similar groups (e.g. Selbaek et al., 2008) reported good inter-rater reliability across different health professionals. In addition, excellent inter-rater reliability has been shown in studies of the NPI on dementia outpatients (Leung et al., 2001). However, further research on the NPI-ID should include tests of its inter-rater reliability, particularly since this may vary between different symptoms (Selbaek et al., 2008).

5 | CONCLUSIONS

The results of the current study provide support for the use of NPI-ID as a screening test for symptoms of psychiatric morbidity and problem behaviours among people with intellectual disabilities. The psychometric properties of the NPI-ID were satisfactory. Three distinct symptom profile groups were identified, and preliminary cut-offs were suggested, which can be used to identify individuals with need of special treatment or examination by a specialist. Additional research is recommended to further evaluate the utility and psychometric properties of the NPI-ID in comparison with other assessment tools used for people with intellectual disabilities living in group homes.

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CONFLICT OF INTEREST

None.

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REFERENCES

Aarsland, D., Brønnick, K., Ehrt, U., De Deyn, P. P., Tekin, S., Emre, M., & Cummings, J. L. (2007). Neuropsychiatric symptoms in patients with Parkinson's disease and dementia: Frequency, profile and associated care giver stress. *Journal of Neurology, Neurosurgery, and Psychiatry*, *78*(1), 36–42.

Ahlström, G., Kulneff, S., & Granvik, E. (2016). *NPI-ID Manual*. Lund, Sweden: Department of Health Services, Lund University. (In Swedish, unpublished manuscript, can be obtained by contacting the authors).

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.

Axmon, A., Björne, P., Nylander, L., & Ahlström, G. (2018). Psychiatric diagnoses in relation to severity of intellectual disability and challenging behaviors: a register study among older people. *Aging & Mental Health*, *22*(10), 1344–1350.

Baker, P., & Daynes, S. (2010). Outcome measurement for people with intellectual disability who present challenging behaviour. *Advances in Mental Health and Intellectual Disabilities*, *4*(2), 13–19.

Baranzini, F., Grecchi, A., Berto, E., Costantini, C., Ceccon, F., Cazzamalli, S., & Callegari, C. (2013). Factor analysis and psychometric properties of the Italian version of the Neuropsychiatric Inventory-Nursing Home in an institutionalized elderly population with psychiatric comorbidity. *Rivista Di Psichiatria*, *48*(4), 335–344.

Camozzato, A. L., Kochhann, R., Simeoni, C., Konrath, C. A., Franz, A. P., Carvalho, A., & Chaves, M. L. (2008). Reliability of the Brazilian Portuguese version of the Neuropsychiatric Inventory (NPI) for patients with Alzheimer's disease and their caregivers. *International Psychogeriatrics*, *20*(2), 383–393.

Cobigo, V., Morin, D., & Mercier, C. (2012). Evaluating the effectiveness of a program targeting behaviour disorders: The development of a logic model. *Journal on Developmental Disabilities*, *18*(1), 87–95.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Cronbach, L. (1951). Coefficient alpha and the internal structure of tests. *Psychomerika*, *16*, 297–334.

Cummings, J. L. (1997). The Neuropsychiatric Inventory Assessing psychopathology in dementia patients. *Neurology*, *48*(5 Suppl 6), 10S–16S.

Cummings, J. L. (2009). *Neuropsychiatric Inventory Nursing Home Version (NPI-NH). Comprehensive assessment of psychopathology in patients with dementia residing in nursing homes*. Retrieved from http://www.dementiamanagementstrategy.com/File.axd?id=c9f7405f-3596-7404f7405f-7409f7408d-f7322e5188678

Cummings, J. L., Mega, M., Gray, K., Rosenberg-Thompson, S., Carusi, D. A., & Gornbein, J. (1994). The Neuropsychiatric Inventory comprehensive assessment of psychopathology in dementia. *Neurology*, *44*(12), 2308–2314.

Davis, J. P., Judd, F. K., & Herrman, H. (1997). Depression in adults with intellectual disability. 1. A review. *Australian and New Zealand Journal of Psychiatry*, *31*, 232–242.

Deb, S., Thomas, M., & Bright, C. (2001). Mental disorder in adults with intellectual disability. 1: Prevalence of functional psychiatric illness among a community-based population aged between 16 and 64 years. *Journal of Intellectual Disability Research*, *45*(6), 495–505.

Dechamps, A., Jutand, M. A., Onifade, C., Richard-Harston, S., & Bourdel-Marchasson, I. (2008). Co-occurrence of neuropsychiatric syndromes in demented and psychotic institutionalized elderly. *International Journal of Geriatric Psychiatry*, *23*(11), 1182–1190.

Einfeld, S. L., Ellis, L. A., & Emerson, E. (2011). Comorbidity of intellectual disability and mental disorder in children and adolescents: A systematic review. *Journal of Intellectual and Developmental Disability*, *36*(2), 137–143.

Emerson, E. (2001). *Challenging behaviour: Analysis and intervention in people with severe intellectual disabilities*. Cambridge, UK: Cambridge University Press.

Emerson, E., Kiernan, C., Alborz, A., Reeves, D., Mason, H., Swarbrick, R., … Hatton, C. (2001). The prevalence of challenging behaviors: A total population study. *Research in Developmental Disabilities*, *22*(1), 77–93.

Fayers, P. M., & Machin, D. (2016). *Quality of life: The assessment, analysis, and reporting of patient-reported outcomes* (3rd ed.). Chichester, West Sussex, UK: John Wiley & Sons Inc.

Fineout-Overholt, E., Melnyk, B. M., & Schultz, A. (2005). Transforming health care from the inside out: Advancing evidence-based practice in the 21st century. *Journal of Professional Nursing*, *21*(6), 335–344.

Funca. (2019). *Funca - Ett arbetsverktyg för personal inom LSS*. Retrieved from http://funca.nu/

Gerber, F., Bessero, S., Robbiani, B., Courvoisier, D. S., Baud, M. A., Traoré, M.-C., … Galli Carminati, G. (2011). Comparing residential programmes for adults with autism spectrum disorders and intellectual disability: Outcomes of challenging behaviour and quality of life. *Journal of Intellectual Disability Research*, *55*(9), 918–932.

Granvik, E., Minthon, L., Nägga, K., Hylén, M., & Kumlien, C. (2018). *Translation of the NPI-NH into Swedish and test for inter rater reliability*. Unpublished manuscript.

Gravestock, S. (2000). Eating disorders in adults with intellectual disability. *Journal of Intellectual Disability Research*, *44*, 625–637.

Hemmings, C., Gravestock, S., Pickard, M., & Bouras, N. (2006). Psychiatric symptoms and problem behaviours in people with intellectual disabilities. *Journal of Intellectual Disability Research*, *50*(4), 269–276.

Holden, B., & Gitlesen, J. P. (2003). Prevalence of psychiatric symptoms in adults with mental retardation and challenging behaviour. *Research in Developmental Disabilities*, *24*(5), 323–332.

Hove, O. (2004). Prevalence of eating disorders in adults with mental retardation living in the community. *American Journal on Mental Retardation*, *109*(6), 501–506.

Hove, O. (2007). Survey on dysfunctional eating behavior in adult persons with intellectual disability living in the community. *Research in Developmental Disabilities*, *28*(1), 1–8.

Johnson, D. K., Watts, A. S., Chapin, B. A., Anderson, R., & Burns, J. M. (2011). Neuropsychiatric profiles in dementia. *Alzheimer Disease and Associated Disorders*, *25*(4), 326–332.

Jones, E. (2013). Back to the future: Developing competent residential services for people with intellectual disabilities and challenging behaviour. *Advances in Mental Health and Intellectual Disabilities*, *7*(1), 5–17.

Kørner, A., Lauritzen, L., Lolk, A., Abelskov, K., Christensen, P., & Nilsson, F. M. (2008). The Neuropsychiatric Inventory—NPI. Validation of the Danish version. *Nordic Journal of Psychiatry*, *62*(6), 481–485.

Lai, C. K. (2014). The merits and problems of Neuropsychiatric Inventory as an assessment tool in people with dementia and other neurological disorders. *Clinical Interventions in Aging*, *9*, 1051–1061.

Lange, R. T., Hopp, G. A., & Kang, N. (2004). Psychometric properties and factor structure of the Neuropsychiatric Inventory Nursing Home version in an elderly neuropsychiatric population. *International Journal of Geriatric Psychiatry*, *19*(5), 440–448.

Leung, V. P., Lam, L. C., Chiu, H. F., Cummings, J. L., & Chen, Q. (2001). Validation study of the Chinese version of the neuropsychiatric inventory (CNPI). *International Journal of Geriatric Psychiatry*, *16*(8), 789–793.

Linacre, J. M. (2002). Optimizing rating scale category effectiveness. *Journal of Applied Measurement*, *3*(1), 85–106.

Lloyd, B. P., & Kennedy, C. H. (2014). Assessment and treatment of challenging behaviour for individuals with intellectual disability: A research review. *Journal of Applied Research in Intellectual Disabilities*, *27*(3), 187–199.

Lundqvist, L.-O. (2013). Prevalence and risk markers of behavior problems among adults with intellectual disabilities: A total population study in Örebro County. *Sweden. Research in Developmental Disabilities*, *34*(4), 1346–1356.

Mayer, S., Granvik, E., Minthon, L., & Nägga, K. (2014). Improved quality of life by active intervention with the Swedish BPSD registry. *Alzheimer's & Dementia: The Journal of the Alzheimer's Association*, *10*(4), 139–140.

Melander, C., Sävenstedt, S., Olsson, M., & Wälivaara, B. M. (2018). Assessing BPSD with the support of the NPI-NH: A discourse analysis of clinical reasoning. *International Psychogeriatrics*, *30*(4), 581–589.

Nunnally, J., & Bernstein, L. (1994). *Psychometric theory*. New York, NY: McGraw-Hill.

Poppes, P., Van der Putten, A., & Vlaskamp, C. (2010). Frequency and severity of challenging behaviour in people with profound intellectual and multiple disabilities. *Research in Developmental Disabilities*, *31*(6), 1269–1275.

Robertson, J., Emerson, E., Pinkney, L., Caesar, E., Felce, D., Meek, A., … Hallam, A. (2005). Treatment and management of challenging behaviours in congregate and noncongregate community-based supported accommodation. *Journal of Intellectual Disability Research*, *49*(1), 63–72.

Rojahn, J., Matson, J. L., Naglieri, J. A., & Mayville, E. (2004). Relationships between psychiatric conditions and behavior problems among adults with mental retardation. *American Journal on Mental Retardation*, *109*(1), 21–33.

Schalock, R. L., Borthwick-Duffy, S. A., Bradley, V. J., Buntinx, W. H. E., Coulter, D. L., Craig, E. M., & Yeager, M. H. (2010). *Intellectual disability: Definition, classification, and systems of supports* (11th ed.). Washington, DC: American Association on Intellectual and Developmental Disabilities.

Selbaek, G., Kirkevold, Ø., Sommer, O. H., & Engedal, K. (2008). The reliability and validity of the Norwegian version of the Neuropsychiatric Inventory, nursing home version (NPI-NH). *International Psychogeriatrics*, *20*(2), 375–382.

Spalletta, G., Baldinetti, F., Buccione, I., Fadda, L., Perri, R., Scalmana, S., … Caltagirone, C. (2004). Cognition and behaviour are independent and heterogeneous dimensions in Alzheimer's disease. *Journal of Neurology*, *251*(6), 688–695.

Unwin, G., & Deb, S. (2008). Psychiatric and behavioural assessment scales for adults with learning disabilities. *Advances in Mental Health and Learning Disabilities*, *2*(4), 37–45.

Wood, S., Cummings, J. L., Hsu, M.-A., Barclay, T., Wheatley, M. V., Yarema, K. T., & Schnelle, J. F. (2000). The use of the neuropsychiatric inventory in nursing home residents: Characterization and measurement. *The American Journal of Geriatric Psychiatry*, *8*(1), 75–83.

Zarcone, J., Napolitano, D., & Valdovinos, M. (2008). Measurement of problem behaviour during medication evaluations. *Journal of Intellectual Disability Research*, *52*(12), 1015–1028.

Zuidema, S. U., de Jonghe, J. F. M., Verhey, F. R. J., & Koopmans, R. T. C. M. (2007). Neuropsychiatric symptoms in nursing home patients: Factor structure invariance of the Dutch Nursing Home version of the Neuropsychiatric Inventory in different stages of dementia. *Dementia and Geriatric Cognitive Disorders*, *24*, 169–176.

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