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ABSTRACT

Background: There is a need to evaluate subjective perspectives of outcomes, such as quality of life (QoL), in individuals with autism spectrum disorders (ASD), but to date, there is no specific instrument available to assess this population. While the INICO-FEAPS scale is customized for studying QoL in adolescents and adults with intellectual and/or developmental disabilities, this scale has not been previously evaluated in an ASD population.
Aims: To examine the usability of the INICO-FEAPS scale in a Danish population of adolescents and adults with ASD.
Methods: In a nationwide survey, 875 adolescents and adults with ASD and 1573 parents completed the INICO-FEAPS scale. Internal consistency was evaluated through several indices. Confirmatory factor analysis (CFA) was conducted to investigate the fit of the model with eight correlated first-order factors, and convergent validity was explored comparing the results of different QoL measures through correlation analysis.
Results: Internal consistency was adequate for the indices applied, and the CFA model tested indicated an acceptable fit to the data. Generally, comparisons of results of different QoL measures resulted in moderate to high correlations.
Conclusion: Overall, it was concluded that due to the psychometric properties found, the INICO-FEAPS scale is applicable for use in ASD populations.

What this paper adds

The INICO-FEAPS scale is a recently developed scale for assessing quality of life (QoL) in individuals with intellectual and/or developmental disabilities. The scale is based on Schalock and Verdugo's theoretical model of QoL that is comprised of eight domains: self-determination, rights, emotional wellbeing, social inclusion, personal development, interpersonal relationships, material wellbeing and physical wellbeing. This model is sparsely investigated in the ASD population. This study contributes to the literature by administering the INICO-FEAPS scale to a large Danish population comprised of adolescents and adults with ASD, following an investigation of the psychometric properties of the scale. Statistical analyses of internal consistency, internal structure and convergent validity suggest acceptable psychometric properties of the INICO-FEAPS scale for both self-reporting and parental reporting.

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1. Background

Investigating quality of life (QoL) has become significantly important in both research and clinical practices as the last several decades have emphasized the importance of the individual's perspective regarding values in life and, more importantly, have acknowledged that everyone, regardless of the presence of disabilities, should be included in efforts to enhance their QoL (Schalock, 2004; Schalock, Verdugo, Gomez, & Reinders, 2016). Even though no single definition of QoL exists, most QoL researchers agree on the specific characteristics of the QoL construct, for instance, with respect to the importance of the person's perception of personal satisfaction (i.e., subjectivity) with life in the different domains, such as the physical, psychological, and social spheres (i.e., multidimensionality) (World Health Organization, 1995).

Robert L. Schalock and Miguel Á. Verdugo have developed a model of QoL that is comprised of eight domains, namely, self-determination, rights, emotional wellbeing, social inclusion, personal development, interpersonal relationships, material wellbeing and physical wellbeing (Schalock & Verdugo, 2002; Schalock et al., 2016). The importance of the eight domains has been empirically and transculturally validated in several studies (Gomez, Verdugo, Arias, & Arias, 2011; Jenaro et al., 2005; Schalock et al., 2005; Wang, Schalock, Verdugo, & Jenaro, 2010), and although the model has been applied primarily in the field of intellectual and developmental disabilities, it is not limited to this field (van Hecke et al., 2017). Based on Schalock and Verdugo's model of QoL, several instruments using different methods of collection of information have been developed to assess QoL, including the Personal Outcome Scale (Van Loon, Van Hove, Schalock, & Claes, 2008), the San Martin Scale (Verdugo, Gomez, Arias, Navas, & Schalock, 2014), the INTEGRAL scale (Gómez, Arias, Verdugo, & Navas, 2012), the GENCAT Scale (Verdugo, Arias, Gómez, & Schalock, 2010), and the INICO-FEAPS scale (Gomez, Verdugo, & Arias, 2015).

Recent reviews of QoL studies (Ayres et al., 2017; Chiang & Wineman, 2014; Ikeda, Hinckson, & Krägeloh, 2014) and a meta-analysis (Van Heijst & Geurts, 2015) of QoL in individuals with autism spectrum disorders (ASD) illustrate well the range of different instruments in operationalizing QoL. However, to date, no specific QoL instrument for individuals with ASD has been developed, and there is no consensus about which of the existing instruments best capture the important aspects of QoL in the ASD population. Plimley (2007) suggested transferring the knowledge from research in the field of QoL, particularly research based on Schalock and Verdugo's QoL model, to individuals with ASD. Yet, to date only one study with an ASD study population has reported psychometric properties of a QoL scale based on Schalock and Verdugo's model comprised of the eight QoL domains (Arias et al., 2017).

The INICO-FEAPS scale consists of two forms, the self-report form and the report of others form (Gomez et al., 2015), and is the instrument chosen for the present study. Originally, the INICO-FEAPS scale was developed to assess QoL in individuals with intellectual/developmental disabilities who receive different types of support. Even though not all individuals with ASD are suffering from intellectual disability (ID), and they are not all receiving support, it is well known that a subgroup of individuals with ASD has ID, and an even larger group of individuals with ASD are receiving different types of support, a factor that can substantially affect self-determination. Using the INICO-FEAPS scale among an ASD population can be advantageous compared to the more generic measures of QoL since the INICO-FEAPS scale accounts for the dependency on services and support that often characterizes individuals with ASD on a group level. Furthermore, this scale can promote the self-report form for QoL by using a customized instrument that enables as large a group of individuals with ASD as possible, including those with ID, to complete the questionnaire. Hence, the application of a scale written in a plain language makes self-reporting more accessible to a larger group of the study population.

QoL researchers argue that self-reports on QoL are the only valid reports (Schalock et al., 2002). Additionally, a review addressing the assessment of QoL in children and adolescents with ASD (Ikeda et al., 2014) indicates there are considerable differences between self-reports on QoL and reports completed by others, thus emphasizing that these two sources of information are not interchangeable, and furthermore should be analyzed separately (Verdugo, Schalock, Keith, & Stancliffe, 2005). Yet, research indicates that parental ratings with an instruction of rating the QoL as they think, their child would do themselves, yield results that are better aligned with the ratings the involved individuals would give compared to standard parental ratings where no such instruction were given (Hong, Bishop-Fitzpatrick, Smith, Greenberg, & Mailick, 2016; Sheldrick, Neger, Shipman, & Perrin, 2012). Further, there are individuals who are unable to self-report on their QoL, and thus, allowing the parents to report on behalf of their children may be the second-best solution. Accordingly, it is valuable to use an instrument like the INICO-FEAPS scale consisting of both a self-report form and report of others form in ASD populations.

As argued by Ikeda et al. (2014), it is important to establish the psychometric properties of the QoL scale applied in an ASD population prior to reporting the results from the specific scale. Particularly, the purpose of this study was to examine the usability of the INICO-FEAPS scale in a population of adolescents and adults with ASD. Therefore, we investigated the psychometric properties of the scale by applying the same methods used when Gomez et al. (2015) validated the original version of the scale. In addition to internal consistency, Gomez et al. (2015) explored the internal structure of the scale by testing four different models using confirmatory factor analysis (CFA) and concluded that a model with eight correlated first-order factors best fit the data. Accordingly, we aimed to investigate the fit of the same model when INICO-FEAPS was administered in an ASD population. Beyond investigating the internal consistency and internal structure, this study further compared the results for proxy-reporting and self-reporting of different QoL measures with the purpose of exploring convergent validity.

2. Method

2.1. Participants

The study population consists of 875 adolescents and adults with ASD and 1573 parents who completed the self-report or the

Table 1
Description of the study population.

	Study population according to questionnaire using self-report (n = 875)	Study population according to questionnaire using report of others (n = 1573)
	n (%)	n (%)
Gender		
Male	687 (78.5)	1274 (81.0)
Female	188 (21.5)	299 (19.0)
ICD-10 ASD diagnosis		
Infantile autism	192 (21.9)	419 (26.6)
Atypical autism	77 (8.8)	163 (10.4)
Asperger's syndrome	310 (35.4)	603 (38.3)
Other PDD	91 (10.4)	167 (10.6)
ASD not classified according to ICD-10	205 (23.4)	221 (14.0)
Intellectual disability		
Yes	75 (8.6)	229 (14.6)
No	618 (70.6)	1199 (76.2)
Missing	182 (20.8)	145 (9.2)
Residence		
Living with parents	454 (51.9)	886 (56.3)
Independently without support	139 (15.9)	297 (18.9)
Outside family home with support	121 (13.8)	327 (20.8)
Missing	161 (18.4)	63 (4.0)
Daytime activity		
None	114 (13.0)	258 (16.4)
Normative education	232 (26.5)	439 (27.9)
Customized education	124 (14.2)	276 (17.5)
Normative occupation	30 (3.4)	104 (6.6)
Customized occupation	55 (6.3)	136 (8.6)
Missing	320 (36.6)	360 (22.9)

n = sample size; ASD = autism spectrum disorder; Other PDD = other pervasive developmental disorder.

report of others form of the INICO-FEAPS scale. For 710 individuals with ASD, both self-reports and reports of others were completed. The mean age ± SD for individuals with ASD was 20.47 ± 2.76 years for questionnaires completed by individuals with ASD, and 20.71 ± 2.75 years for questionnaires completed by parents. Information on gender, ICD-10 autism diagnosis, proportion of ID, residence, and current daytime activity is provided in Table 1. Daytime activity is categorized into five subgroups including no regular daytime activity, normative occupation (equal to employment without support), normative education (attending post-secondary, upper secondary, or primary and lower secondary school), customized employment (e.g. employment with support or in sheltered vocational settings) and customized education (e.g. attending a customized educational program). Of the ASD study population answering the self-report questionnaire, 24.57% reported that they completed the INICO-FEAPS scale with assistance from another person.

2.2. QoL instruments

The INICO-FEAPS scale features two forms, a self-report form and a report of others form. Both forms of the scale consist of 72 items divided among eight subdomains, self-determination (SD), rights (RI), emotional wellbeing (EMO), social inclusion (INCL), personal development (DEV), interpersonal relationships (RE), material wellbeing (MAT), and physical wellbeing (PHY). The content of each item is the same across the two forms of the scale. Both written and visual instructions for completing the scale were provided in the self-report form, whereas the report of others form has written instructions only. For each item, the following four response options were available: never, sometimes, often, and always. This resulted in a score for each item ranging from 1 to 4 or 4–1 depending on whether the wording of the specific item was reversed. Each subdomain score is calculated by summing up the score for each of the nine items, and a total score is then calculated by summing up the domain scores. The development of the INICO-FEAPS scale is described in detail in Gomez et al. (2015).

In this study, the INICO-FEAPS scale was administered to both adolescents and adults with ASD as well as to their parents. However, it was necessary to perform a few modifications. Gomez et al. (2015) stated that the scale is intended for adolescents and adults participating in some type of occupational activity or engaged in some type of professional work as some items are related to this topic. In our sample, because we knew beforehand that some participants were still enrolled in education, we slightly modified the relevant items by including the possibility of being enrolled in education. Moreover, the scale includes, in item 45 of the self-report form, an extra guideline. Specifically, it addresses the need for technical support in everyday life, such as adapted keyboard and pictograms, i.e., "If you do not need technical help, select ALWAYS." Similarly, we added similar extra guidelines to seven items to make answering possible for individuals living and managing life independently in proportion to the content of the specific items.

The first author of the original paper on the INICO-FEAPS scale (Gomez et al., 2015), Laura E. Gomez, kindly gave advice in connection with these modifications (personal communication, September 3–4, 2015). Despite these minor modifications, the Danish version of the INICO-FEAPS scale was considered comparable to the original scale, as the modifications were few and did not change the main content of the original items. In the report of others form, the parents were instructed to rate their child's QoL as they believed the children themselves would rate it.

In addition to the INICO-FEAPS scale, the individuals with ASD were asked to complete the Personal Wellbeing Index (PWI) – intellectual disability (Cummins & Lau, 2005). The PWI is a seven-item scale where each item ranges from a score of 0 (not satisfied at all) to 10 (completely satisfied) and the summing up of the item scores constitutes a total score. The intellectual disability form of the PWI was used due to the form's easily understandable language. Furthermore, a single-item visual analogue scale that measures QoL (single-item VAS QoL scale) was applied to individuals with ASD and their parents. This item covered "satisfaction with life as a whole" ranging from 0 (not satisfied at all) to 10 (completely satisfied). This item is similar to the optional item on the PWI (International Wellbeing Group, 2013), but it is also used in other research settings (de Boer et al., 2004). As was the case with parental reports on the INICO-FEAPS scale, the parents were instructed to complete the single-item VAS QoL scale as they thought their son or daughter would do. The order of the QoL scales on the questionnaire was as follows: the single-item VAS QoL scale, the PWI (self-report only), and the INICO-FEAPS scale.

2.3. Procedure

This study is part of a Danish nationwide survey conducted for the purpose of exploring outcomes among adolescents and adults with ASD, including outcome on QoL. The sample of the survey included all individuals born 1990–1999 and diagnosed with ASD in childhood at Danish child psychiatric hospitals before the age of 14 years. They were identified in the Danish Psychiatric Central Research Registry (Mors, Perto, & Mortensen, 2011) and contacted via mail, thereby invited to take part in an online survey. Several analyses comparing responders and non-responders of the survey were performed with comparisons of psychiatric history and ICD-10 autism diagnoses of the individuals with ASD, and sociodemographics of the individuals with ASD as well as their parents. Only minor differences were found, however with a tendency that socioeconomically advantaged families participated more often (Knüppel, Kjærsdam Telléus, & Lauritsen, 2017).

It was necessary to translate the original English versions of the INICO-FEAPS and the PWI into Danish. The aim was to develop Danish versions of the scales using easily accessible Danish language with content equivalent to the original versions. Two native Danish speakers translated the scales independently, and three of the authors (AK, MBL, & GKT) discussed and decided on the best Danish translations for each item of the scales. Next, the first version of each scale was piloted in a small group of adults (N = 6) who specialized in ASD or the Danish language. The pilot resulted in profound feedback regarding the wording(s) of the items. The new Danish versions of the scales were prepared and then back-translated into English by a bilingual English–Danish native English-speaking psychologist with no knowledge of the original English versions. Comparisons between the original English versions and the English versions derived from the translated Danish versions resulted in a few corrections, which were included in the final Danish versions of the scales.

The informants of the study (i.e., both parents and individuals with ASD) were informed about the purpose and content of the study, and it was explained that participation was voluntary. In case of any questions regarding the study, it was possible to contact a researcher (AK) by phone or e-mail. Data were anonymized prior to statistical analysis, and the study was registered with The Danish Data Protection Agency (record no. 2008-58-0028).

2.4. Data analysis

In general, it was accepted that each person completing the INICO-FEAPS scale could fail to answer a single item in each domain and still be included in the study. For self-reports this implied that additional 108 individuals could be added to the sample, and for report of others this was true for additional 290 individuals. For self-report a maximum of three missing items each person was found, whereas for report of others the number was four. Overall, out of the total number of items, 0.20% and 0.35% were missing for self-reports and report of others, respectively. Hence, the proportions were small and therefore not assumed to introduce substantial bias in the analyses conducted. With respect to the PWI and the single-item VAS QoL scale, it was required that all items should be completed.

The internal consistency of the INICO-FEAPS scale was evaluated using the ordinal version of Cronbach's alpha (Cronbach, 1951). As argued by Gadermann, Guhn and Zumbo (2012) and conducted by Gomez et al. (2015), ordinal alpha estimates alpha more accurately for measurements comprised of ordinal data. Furthermore, the internal consistency was evaluated using average item total correlation, ordinal theta, McDonald's omega and average variance extracted (AVE). The calculation of average item total correlation was based on fully completed scales with no missing data. For calculation of ordinal alpha and ordinal theta, missing values on the INICO-FEAPS scale were accounted for by using pairwise deletion in the calculation of the polychoric correlation matrix. Prior to the calculation of McDonald's omega and AVE, the items within each domain were parceled into groups of three based on skewness (Holt, 2004), and the dimensionality of each parcel was examined through iterated principal-factor analysis to ensure that each parcel was unidimensional. The same parceling method was used prior to conducting CFA of the eight correlated first-order factors. The purpose of the analysis was to confirm the internal structure of the INICO-FEAPS scale, i.e., to evaluate the existence of the eight QoL domains as eight correlated first-order factors. In other words, it was not to remove or add items. Hence, it was considered appropriate to use parcels to reduce the number of estimated parameters and thus the sources of sampling errors in the model (Little, Cunningham,

Table 2
Internal consistency for each domain in the INICO-FEAPS scale.

Domain	Self-report			Report of others		
	$r_{i\text{-}t}$	Ordinal α	Ordinal θ	$r_{i\text{-}t}$	Ordinal α	Ordinal θ
SD	0.350	0.713	0.729	0.473	0.834	0.838
RI	0.416	0.752	0.759	0.402	0.773	0.792
EMO	0.574	0.898	0.900	0.520	0.864	0.888
INCL	0.507	0.767	0.772	0.594	0.852	0.853
DEV	0.502	0.796	0.801	0.627	0.874	0.877
RE	0.496	0.819	0.827	0.591	0.896	0.898
MAT	0.492	0.816	0.834	0.531	0.847	0.856
PHY	0.340	0.658	0.671	0.374	0.733	0.740

SD = self-determination; RI = rights; EMO = emotional wellbeing; INCL = social inclusion; DEV = personal development; RE = interpersonal relationships; MAT = material wellbeing; PHY = physical wellbeing; $r_{i\text{-}t}$ = average item total correlation; Ordinal α = ordinal alpha (standardized); Ordinal θ = ordinal theta.

Shahar, & Widaman, 2002). In the CFA model, missing values on the INICO-FEAPS scale were accounted for by using maximum likelihood as the estimation method (Allison, 2003). The goodness of fit of the model was evaluated using a chi-square test, root mean squared error of approximation (RMSEA), comparative fit index (CFI) and coefficient of determination (CD).

Convergent validity was explored by comparing the raw total of the INICO-FEAPS scale to the result of the single-item VAS QoL scale and the raw total of the PWI (for self-reports only) using Pearson or Spearman correlations, whichever was most appropriate considering the distribution of the included variables. In these analyses, missing values in the INICO-FEAPS scale were handled with multiple imputations, with five imputations for each missing value. The statistical analyses were performed using STATA version 14.2 (StataCorp., 2015a) and R version 3.2.5 (R Core Team, 2016).

3. Results

3.1. Internal consistency

The results for average item total correlation, ordinal alpha and ordinal theta are presented in Table 2. Average item-total correlation ranged from 0.340 to 0.574 for the self-report form and from 0.374 to 0.627 for the report of others form, thus indicating good internal consistency for all domains. As suggested by Nunnally and Bernstein (1994), an item-total correlation value of 0.3 guides the discrimination of items. The lowest values for item-total correlations were found for the domains of *physical wellbeing* and *rights* for both the self-report and report of others forms. Further, the domain of *self-determination* for the self-report form had a low value for item-total correlation. These results indicated lower internal consistency for these domains, however all values were above 0.3. Ordinal alpha ranged from 0.658 to 0.898 for self-report and from 0.733 to 0.896 for report of others, indicating acceptable to good values for all domains, with only one domain (*physical wellbeing* in self-report) having a value of alpha slightly lower than the often-used threshold value of 0.7 (Gadermann et al., 2012). With respect to the self-report form, internal consistency was highest in the domain of *emotional wellbeing*, and for the report of others form, in the domain of *interpersonal relationships*. On the contrary, internal consistency was lowest for *physical wellbeing* for both forms. Similar results were found for ordinal theta (see Table 2). Overall, the results indicated adequate internal consistency within each domain for both the self-report and report of others form.

3.2. Evaluation of internal structure

The internal structure of the INICO-FEAPS scale was evaluated using CFA with each domain corresponding to one factor. To replicate the method applied in Gomez et al. (2015), the nine items within each domain were parceled into groups of three based on skewness before conducting the CFA. The results of the examination of the dimensionality of each parcel are summarized in Table 3.

Table 3
Iterated principal-factor analysis of each group of three items, i.e., each parcel (n = 24).

	Self-report			Report of others		
	Mean	Min	Max	Mean	Min	Max
Eigenvalue factor 1	0.92	0.15	1.82	1.23	0.63	1.79
Eigenvalue factor 2	4.89×10^{-3}	1.06×10^{-4}	0.08	2.72×10^{-3}	7.92×10^{-5}	0.06
Eigenvalue factor 3	−0.03	−0.27	-1.20×10^{-4}	−0.01	−0.19	-8.79×10^{-5}
Variance explained by factor 1 (%)	30.82	4.84	60.60	40.85	21.15	59.77
Variance explained by factor 2 (%)	0.16	3.55×10^{-3}	2.82	0.09	2.64×10^{-3}	2.04
Difference between the two explained variances	30.66	2.02	60.60	40.76	21.15	59.77

n = sample size (i.e., number of parcels).

The variance explained by a possible second factor in each parcel was close to zero for almost every parcel, indicating that one factor was sufficient to explain almost all of the variance in each parcel, i.e., the parcels were considered to be unidimensional. More specifically, only two parcels from the self-report form and one parcel from the report of others form did not clearly demonstrate unidimensionality. Regarding the self-report form, the difference between explained variance for factor one and factor two was smaller than 5.00% in one parcel from the domain of *physical wellbeing* and in one parcel from the domain of *self-determination*, whereas the rest of the parcels on the self-report form exhibited a difference of 17.74% or higher. These two parcels exhibited extremely low proportions of explained variance for the first factor, which made the differences in explained variance equally low. Additionally, regarding the report of others form, the explained variance of factor one was 47.68% and that of factor two was 2.04% for one parcel in *emotional wellbeing*. Even though the variance explained by factor two was a slightly higher than zero, hence suggesting two factors, the majority of the variance was explained by the first factor, which means that the difference between having one and two factors was negligible. For the three parcels concerned, they all included two or three items that were not highly correlated, which is evident when the parcels were established based on skewness and not correlations. However, only one parcel in each domain was affected. Overall, since only a few values were diverse, assuming unidimensionality of the parcels was considered acceptable .

Results from the CFA are presented in Fig. 1 and Table 4, and the goodness of fit indices of the applied model are presented in Table 5. Correlations among domains all exceeded 0.3 and, for both scales, were highest between *social inclusion* and *personal development* (self-report 0.86; report of others 0.87), *social inclusion* and *interpersonal relationships* (self-report 0.86; report of others 0.92), and *personal development* and *material wellbeing* (self-report 0.85; report of others 0.84). Additionally, high correlations were found between the domains of *rights* and *self-determination* (0.89), and *rights* and *personal development* (0.82) for self-report. The lowest correlations for self-report were found between the domains of *self-determination* and *emotional wellbeing* (0.39), and *self-determination* and *physical wellbeing* (0.38). With respect to the report of others form, the lowest correlation was between the domains of *rights* and *interpersonal relationships* (0.39) (all correlations are presented in Table 4).

Several goodness of fit indices were calculated, a strategy recommended by Hu and Bentler (1999). Thus, calculating the standardized root mean square residual (SRMSR) was not possible due to the method of imputation of missing values. As was the case in Gomez et al. (2015), we obtained high values and significant results for the chi-square test. However, whether this result was affected by a large sample size cannot be ruled out (Russell, 2002). The values for RMSEA (self-report 0.053; report of others 0.070) indicated acceptable fit with values close to the value of 0.06 (Hu & Bentler, 1999), but with a slightly better value for self-report. The values for CFI were close to the value of 0.95 for both scales (self-report 0.937; report of others 0.914), thereby indicating an acceptable fit (Hu & Bentler, 1999). Again, a more proper value was obtained for self-report, indicating a better fit of the model for this form compared to report of others. Finally, the size of CD indicates a good fit for both forms (report of others 1.000; self-report 0.999) with values close to 1 (StataCorp., 2015b). Overall, a slightly better fit of the pre-defined model in CFA was found for self-report compared to the report of others.

The internal consistency of each domain of the model analyzed using CFA was investigated based on McDonald's omega and AVE, and the results are presented in Table 6. The interpretation of the values of McDonald's omega is equivalent to the interpretation of the alpha coefficients with values exceeding 0.7, thus indicating a reliable measure of the latent variable (Gomez et al., 2015). With respect to the McDonald's omega values for self-report, the domains of *social determination* (0.670), *rights* (0.654), *material wellbeing* (0.695), and *physical wellbeing* (0.625) did not exceed 0.7. This was also the case for the domains of *rights* (0.592) and *physical wellbeing* (0.656) for report of others. The most consistent domains were *emotional wellbeing* (self-report 0.872; report of others 0.853) and *interpersonal relationships* (self-report 0.806; report of others 0.882) on both scales. The value of AVE indicates the accuracy of the construct measured in the proposed model with suggested values above 0.5 explaining at least half of the variance in each domain (Hair, Ringle, & Sarstedt, 2011). From Table 6, it is clear that the domains, which had values just below the suggested threshold for McDonald's omega, also had values just below the suggested threshold for AVE. However, all values for McDonald's omega and AVE approached or exceeded the threshold values.

3.3. Exploring convergent validity

Convergent validity was explored through correlation analyses between the total score of the INICO-FEAPS scale and the total scores from the PWI and the single-item VAS QoL scale, respectively. Interpretations of the results from the correlation analyses should be made with caution as the PWI and the single-item VAS QoL scale are not, at present, validated in a Danish population with ASD. However, the applied scales are, as is the case for the INICO-FEAPS scale, designed and proposed to measure the same construct, i.e., QoL, and moderate to high correlations may be indicative of convergent validity. The results for all possible comparisons between the scales are presented in Table 7.

Overall, correlations were positive and ranged from 0.31 to 0.75 suggesting low to high associations between the QoL measures applied (with 0.30–0.50 indicating a low correlation, 0.50–0.70 indicating a moderate correlation, and 0.70–0.90 indicating a high correlation (Mukaka, 2012)). A pattern of higher correlations between QoL derived from self-reports than the correlations between QoL derived from different informant groups was found. The sizes of the correlations between QoL scores derived from self-reports indicated a moderate to strong relationship between the applied self-reported QoL scales with correlations ranging from 0.59 to 0.75. In contrast, low to moderate correlations were seen in analyses with different informants with correlation ranging from 0.31 to 0.64 with the highest correlations found, when results from QoL scales with parallel versions were compared.
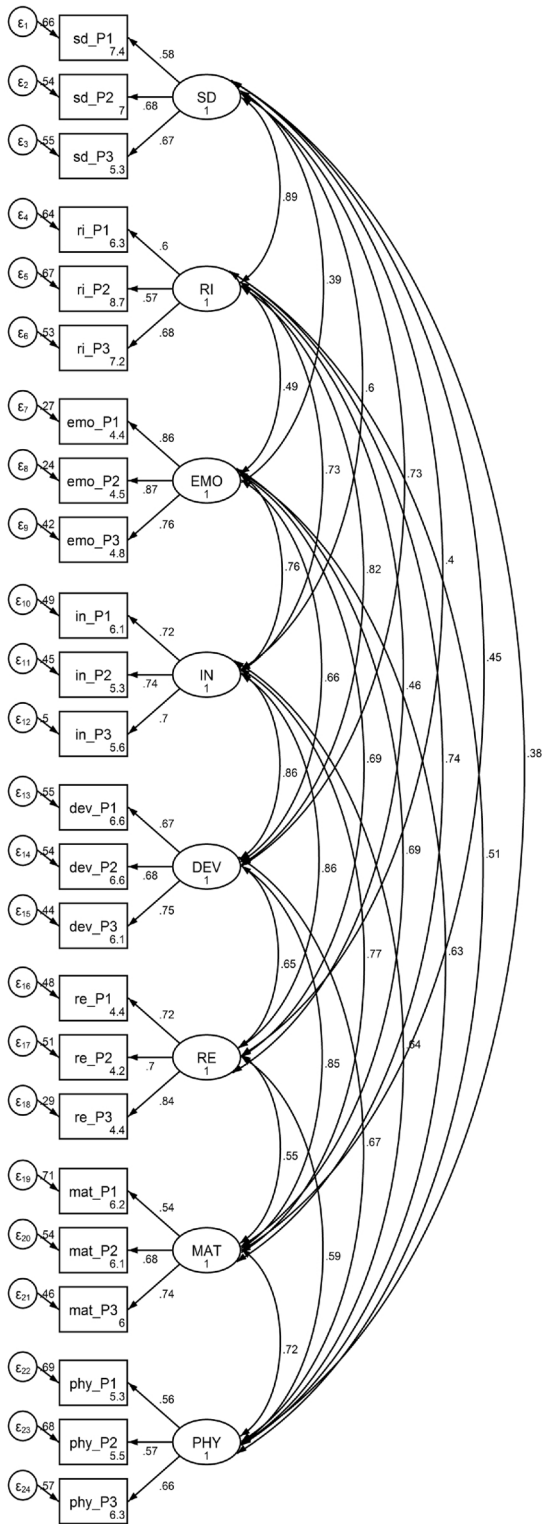
Self-report
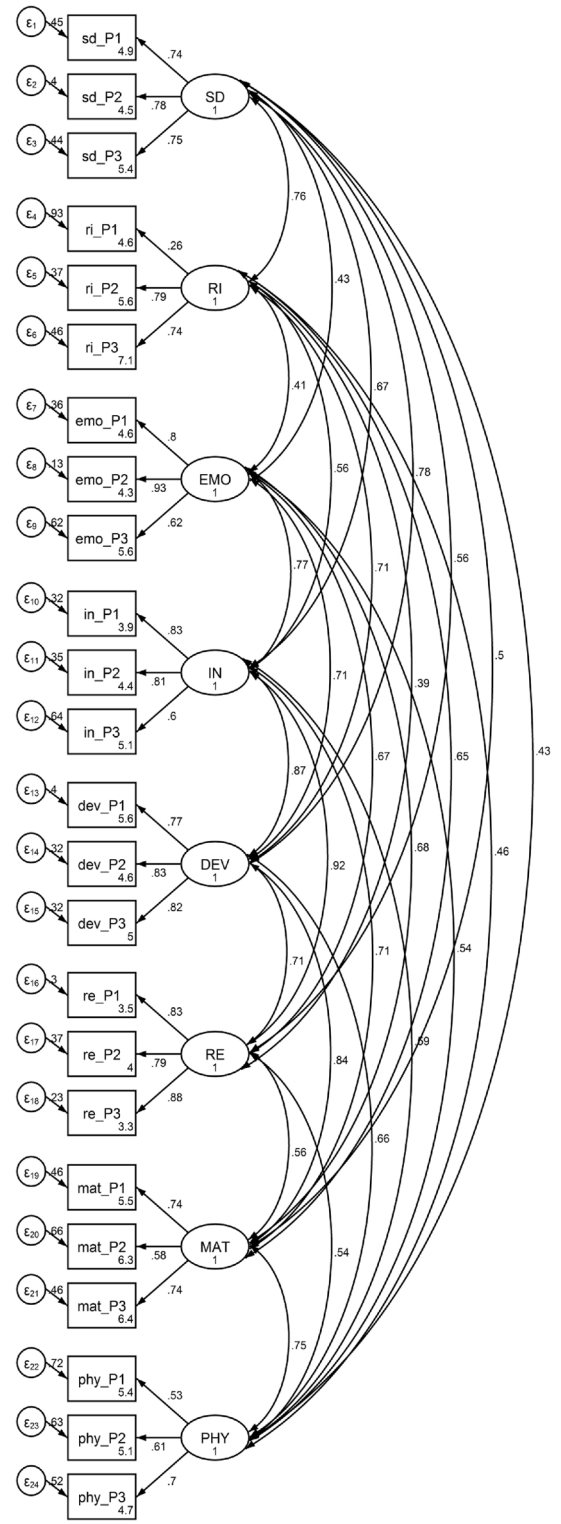
Report of others

Fig. 1. Tested factor structure of INICO-FEAPS.

Results of confirmatory factor analysis testing model with eight inter-correlated factors. P1 = parcel 1; P2 = parcel 2; P3 = parcel 3; SD = self-determination; RI = rights; EMO = emotional wellbeing; INCL = social inclusion; DEV = personal development; RE = interpersonal relationships; MAT = material wellbeing; PHY = physical wellbeing.

Table 4
Correlations among domains in the INICO-FEAPS scale.

	Self-report							Report of others						
	SD	RI	EMO	INCL	DEV	RE	MAT	SD	RI	EMO	INCL	DEV	RE	MAT
RI	0.89							0.76						
EMO	0.39	0.49						0.43	0.41					
INCL	0.60	0.73	0.76					0.67	0.56	0.77				
DEV	0.73	0.82	0.66	0.86				0.78	0.71	0.71	0.87			
RE	0.40	0.46	0.69	0.86	0.65			0.56	0.39	0.67	0.92	0.71		
MAT	0.45	0.74	0.69	0.77	0.85	0.55		0.50	0.65	0.68	0.71	0.84	0.56	
PHY	0.38	0.51	0.63	0.64	0.67	0.59	0.72	0.43	0.46	0.54	0.59	0.66	0.54	0.75

SD = self-determination; RI = rights; EMO = emotional wellbeing; INCL = social inclusion; DEV = personal development; RE = interpersonal relationships; MAT = material wellbeing; PHY = physical wellbeing.

Table 5
Goodness of fit indices.

Fit statistic	Self-report	Report of others
χ^2: Likelihood ratio test model vs. saturated (df = 224)	769.78	1959.95
p-value	< 0.001	< 0.001
RMSEA (90% CI)	.053 (0.049–0.057)	0.070 (0.067–0.073)
p-value	0.129	< 0.001
CFI	0.937	0.914
Size of residuals, CD	0.999	1.000

df = degrees of freedom; RMSEA = root mean square error of approximation; (90% CI) = 90 percent confidence interval for RMSEA; *p*-value = *p*-value for test of close fit; CFI = comparative fit index; CD = coefficient of determination.

Table 6
McDonald's omega and average variance extracted.

Domain	Self-report		Report of others	
	McDonald's Ω	AVE	McDonald's Ω	AVE
SD	0.670	0.411	0.801	0.578
RI	0.654	0.389	0.592	0.353
EMO	0.872	0.697	0.853	0.675
INCL	0.767	0.531	0.800	0.581
DEV	0.748	0.505	0.851	0.658
RE	0.806	0.579	0.882	0.710
MAT	0.695	0.443	0.737	0.482
PHY	0.625	0.358	0.656	0.403

SD = self-determination; RI = rights; EMO = emotional wellbeing; INCL = social inclusion; DEV = personal development; RE = interpersonal relationships; MAT = material wellbeing; PHY = physical wellbeing; McDonald's Ω = McDonald's omega; AVE = average variance extracted.

4. Discussion

The aim of this study was to evaluate the psychometric properties of the INICO-FEAPS scale when administered to adolescents and adults with ASD following the methods of data analysis used when Gomez et al. (2015) validated the original version of the scale. In this study, internal consistency, internal structure and convergent validity were evaluated.

For all indices used for evaluation of internal consistency, the lowest values were found for the domain *physical well-being*. This result is similar to the results of Gomez et al. (2015). Overall, the internal consistency was slightly higher for report of others compared with self-reports, with more domains for self-reports having values below cut-offs for the indices used. However, as found in the results section, all values for internal consistency for both self-reports and report of others in this study (i.e. average item-total correlation, ordinal alpha, ordinal theta, McDonald's omega, AVE) approached or exceeded the threshold values. Unlike Gomez et al. (2015), who found good results for report of others and poor results for self-reporting according to McDonald's omega and AVE, we found mixed results for both forms of the scale. There might be at least two reasons for this discrepancy. First, it may point to

Table 7
Correlations between different measures of quality of life. .

Informant (quality of life scale)		Correlation		n
Self-report (IF)	Report of others (IF)	0.64	[a]	710
Self-report (IF)	Self-report (VAS)	0.59	[a]	872
Self-report (IF)	Report of others (VAS)	0.47	[a]	739
Self-report (IF)	Self-report (PWI)	0.70	[a]	871
Report of others (IF)	Self-report (VAS)	0.31	[a]	740
Report of others (IF)	Report of others (VAS)	0.51	[a]	1567
Report of others (IF)	Self-report (PWI)	0.38	[a]	735
Self-report (VAS)	Report of others (VAS)	0.52	[b]	773
Self-report (PWI)	Self-report (VAS)	0.75	[b]	916
Self-report (PWI)	Report of others (VAS)	0.50	[b]	767

IF = INICO-FEAPS scale; PWI = personal wellbeing index; VAS = single-item visual analogue scale; n = sample size included in the analysis.
[a] Pearson correlation coefficient.
[b] Spearman correlation coefficient.

difficulties for parents when rating the QoL of their son or daughter with ASD. The individuals with ASD in this sample were 16–26 years old, and a subgroup of them were not living with their parents anymore. This might make proxy-reporting even more challenging although parents of adult children with ASD usually are very involved in the lives of their children (Howlin, Moss, Savage, & Rutter, 2013). Second, it may be due to the difference in the samples used for evaluating the INICO-FEAPS scale in our study compared with the study by Gomez et al. (2015). In our sample, the majority did not have ID, which might in general result in a more consistent rating of QoL in each domain. However, different types of language difficulties are frequently found in individuals with ASD, and even though improvements in language skills are often seen from childhood to adulthood (Levy & Perry, 2011), difficulties with for example understanding abstract language as figurative language may persist, also among individuals with ASD with intact or nearly intact structural language competence (Vulchanova, Saldaña, Chahboun, & Vulchanov, 2015). This could potentially make self-reporting challenging for individuals with ASD independent of the presence of ID. Yet, the concrete and simple wordings of the items of INICO-FEAPS might facilitate consistent self-reporting as well for individuals with ASD. The results for internal consistency further suggest the preference of self-report over proxy-report, at least when administering a customized QoL scale as the INICO-FEAPS scale.

Correlations between domains were presented as well, and in comparison with Gomez et al. (2015), an overlap was noted among domains with the highest as well as the lowest correlations; however, generally, we found higher correlations. This result may be explained by differences in the samples used, thus indicating more evenly distributed levels of QoL for each domain within each completed scale in our sample. A pre-defined model of QoL with eight intercorrelated first-order factors with each factor corresponding to a domain in INICO-FEAPS was evaluated with CFA with an acceptable fit, as evaluated through goodness of fit indices, for both self-reports and reports of others. Overall, a slightly better fit of this model was found for self-report compared to the report of others, a result that is similar to the finding by Gomez et al. (2015). Due to the overall aim of our study, analyses enabling comparisons of different hierarchical models of QoL were not conducted, yet the results suggest that the model with eight intercorrelated first-order factors had an acceptable fit to the data used. However recently, using the INICO-FEAPS scale in a Colombian sample of adults with ID, several models of QoL were compared, and the eight intercorrelated first-order factors model were concluded to have the best fit to data (Verdugo-Alonso, Henao-Lema, Córdoba-Andrade, & Arias González, 2017). In addition to previous research investigating the factor structure of QoL (e.g. Gomez et al., 2011), results from the INICO-FEAPS scale completed by Spanish and Colombian, as well as Danish samples likewise support the notion of a multidimensional model of QoL as proposed by Schalock and Verdugo (Schalock & Verdugo, 2002; Schalock et al., 2016).

The results from the correlation analyses comparing different QoL instruments completed by different respondent groups supported the finding that self-reported QoL and proxy-reported QoL illustrate two different sources of information (Ikeda et al., 2014). Overall, the highest correlations were found in comparisons of different QoL assessments completed as self-report. A single analysis comparing proxy QoL scores from two different scales, i.e., the INICO-FEAPS scale and the single-item VAS QoL scale, indicates a moderate correlation in the lower range. This result may illustrate the difficulties related to rating the QoL of another person, which results in a less consistent rating, and/or the fact that the total score from the INICO-FEAPS scale is compared to a score from the single-item VAS QoL scale, where the latter scale may be less reliable given the limited number of items. Overall, the moderate to strong correlations between QoL scores derived from the same informants on different measures indicate convergent validity. However, the issue of construct validity, in general, should be explored further, for example, through a multitrait-multimethod approach in which convergent and discriminant validities are evaluated (Campbell, Campbell, & Fiske, 1959; Strauss & Smith, 2009).

The INICO-FEAPS scale was developed for individuals with intellectual and/or developmental disabilities, and in the original paper of validation a minimum of 80% of the study population had ID (Gomez et al., 2015). For this study sample, the characteristics of the sample, for example proportions of ID, were not known prior to launch of the survey but it turned out that the overall proportion of individuals with ID in this study sample was quite small. This might have implications for the results found, for example due to a potential reduced need of services and support resulting in less relevance of the content of some items in the INICO-FEAPS scale. However, even though an individual has ASD without ID, he or she often needs services. Thus, there is often a considerable gap between cognitive abilities and daily living skills in individuals with ASD and average intelligence (Duncan & Bishop, 2013), which

gives rise to needs of services and support in different settings during life. Further, it should be noticed that some items were slightly changed as described in the methods section to make answering possible for individuals living and managing life independently. Overall, it is assumed that the majority of the sample could complete the scale in a manner that made sense for them.

A strength of this study is that it provided comprehensive evaluations of internal consistency, internal structure, and convergent validity among a large group of individuals diagnosed with ASD using the INICO-FEAPS scale. Nevertheless, there are several limitations to the study as well. First, there is a lack of the necessary data to conduct a more profound investigation of construct validity of the INICO-FEAPS scale. Second, due to the methodology of the study, it was not possible to evaluate test-retest reliability of QoL ratings for neither of the respondent groups. Third, since the INICO-FEAPS scale is developed to be used with individuals with intellectual and/or developmental disabilities, it could have been informative to split the study population according to ID status and compare the psychometric properties of the scale of these subgroups. Yet, due to the small proportion of individuals with ID in this sample this was not possible.

5. Conclusion

This study provides the results of the evaluation of the INICO-FEAPS scale administered to a population of adolescents and adults with ASD. Overall, the internal consistency was found to be adequate for each domain, and the internal structure of the INICO-FEAPS scale as a pre-defined model with eight correlated first-order factors, as proposed by Gomez et al. (2015), fitted the data at an acceptable level. Additionally, the size and direction of the correlations between the different QoL scales for self-report and report of others indicated convergent validity. These results support the previously reported etic properties of Schalock and Verdugo's QoL model (Schalock et al., 2016). Additionally, although the results of this study were quite similar to the results of the original validation paper (Gomez et al., 2015), differences were found that may be explained by the characteristics of the samples used. As mentioned in the introduction, there were theoretical aims for applying the INICO-FEAPS scale based on Schalock and Verdugo's model of QoL in an ASD population. From the present study, it can be concluded that due to the psychometric properties found, the INICO-FEAPS scale is also applicable in ASD populations.

Conflicts of interest

The authors declare that they have no conflict of interests.

Acknowledgements

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