

RESEARCH ARTICLE

The internal structure of foster-parent completed SDQ for school-aged children

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Abstract

Mental health problems are common in foster-children, and tools to measure the mental health of these children are needed. One candidate instrument is the Strengths and Difficulties Questionnaire (SDQ), a measure of child psychological adjustment that is increasingly being employed by Child Protection services. The aim of the current study was to examine the structural validity of the foster parent completed SDQ in a sample of 237 school aged foster children. Confirmatory factor analysis demonstrated an excellent fit of the foster parent completed SDQ data to a five-factor model (CFI = 0.96, RMSEA = 0.05, 90% CI [0.04, 0.06]), thus confirming the structural validity of the five-factor model for the parent-version of the SDQ in Norwegian foster children. Measurement invariance analyses indicated that boys had lower thresholds for fighting with or bullying other children than girls. Girls were on their side more likely to be rated as less popular than boys with a similar level of peer problems.



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Introduction

The high prevalence and comorbidity of mental disorders in foster children [1–3] highlight the need to examine and monitor the mental health of children living in foster homes. Child protection services often have limited competence and resources for conducting in-depth assessments of mental health, making brief screening instruments an attractive option.

The Strengths and Difficulties Questionnaire (SDQ) [4] is a commonly used screening-instrument of psychological adjustment in children and adolescents. The present study examine the internal structure of the five-factor model proposed by Goodman [5].

Since its development, the SDQ has been employed in epidemiological and community surveys, and it is commonly used in clinical practice [6–11]. The validity and clinical utility of the SDQ has been demonstrated in several previous investigations [6, 10, 11]. The SDQ has good concurrent and discriminant validity, and correlates strongly with related scales such as the Youth Self-Report and the Revised Children’s Manifest Anxiety Scale [12–16], it discriminates well between children with and without mental problems [4, 5], it may be used to effectively screen for disorders in community samples [17], and is adequately sensitive to serve as a clinical outcome measure [18]. SDQ has also proven good predictive ability in British looked-after

children ($n = 1391$, of whom 38.6% had a mental disorder; [19]), and a general child protection sample ($n = 292$, 29% of these had contact with mental health care; [20]).

Prior studies of the internal structure of the parent version of the SDQ using confirmatory factor analysis [21–26] have tended to support the original five factor model proposed by Goodman [5]. The still limited amount of research indicates that the Parent SDQ is measurement invariant across gender [22, 26, 27].

Studies in the UK and Canada have demonstrated that the SDQ can be useful for screening, in samples of looked after children [28, 29]. The screening properties of the SDQ has also been demonstrated in a previous study with the same sample as in the current study [30].

The use of the SDQ in child protection contexts is increasing both for research and clinical purposes [31–36]. In the UK, the government has put in place mandatory administration of the SDQ by all primary carers of looked after children [37].

Investigations of the validity of the SDQ, as with the five-factor structure suggested by previous studies of community-samples, are lacking for foster children. This is a significant limitation of the knowledgebase on the suitability of SDQ as a screening instrument for this higher risk population. A previous study has demonstrated a comorbidity-rate for foster children that are significantly higher than that found in both community samples and youths referred to CAMHS [38]. The substantial cross-diagnostic symptom-overlap in this group may decrease the fit of a model hypothesizing five discrete factors of the SDQ when used for this high risk group of children. Palmieri and Smith [22] found support for the five-factor structure of the SDQ in a sample of 773 custodial grandparents. The most common placement form is however placement in foster families consisting of non-biological primary carers. The present study is the first study to investigate if this factor-structure of the SDQ is still valid when regular foster parents are informants.

The aims of the current study were 1) to examine the internal structure of the SDQ in a sample of Norwegian foster parents, and 2) to evaluate whether the SDQ was measurement invariant across gender.

Materials and methods

Participants

Eligible participants were foster children between the age of 6 and 12 years who had lived for at least 5 months in foster families in the 63 municipalities encompassed by the Regional Office for Children, Youth and Family Affairs -South (Bufetat). The regional register at Bufetat listed 391 eligible children, but an additional 28 were identified and added after the office heads of each municipal child protection services revised the lists. Twenty children who had been returned to their biological families, or who had been adopted were excluded from the list. Further, three children were deemed ineligible because of serious neurological disabilities, resulting in a total of 396 children being eligible for inclusion in the study. The current study included 237 children (47.7% girls, mean age = 8.95, SD 2.04) with SDQ completed by foster parents. Analyses revealed that foster fathers and–mothers responded similarly [30], and they were therefore combined into a single group of informants, hereafter referred to as “caregivers”, prioritising information from the foster mothers ($n = 213$) when available, resulting in 20 father completed SDQs. Of the 237 children with caregiver-completed SDQs, 168 children had a custom made Child Protection Questionnaire completed by the caseworker. Independent samples t-tests showed no difference between the children with and without CPQ information ($n = 69$), regarding sex, age or scores on the SDQ Total Difficulties- and subscales. For the subsample with CPQ completed, mean age at first placement was 3.43 (SD 3.07); mean sum of

previous placements was 1.23 (*SD* 1.11); the children had stayed from 5 months to 12 years with their current foster family (mean 4.51, *SD* 3.18).

Measures

The SDQ is a 25-item mental health questionnaire for 3- to 16-year-olds [39]. Versions of SDQ exist for parents and teachers of children aged 4–16, and as a self-report version for children aged 11–16. It consists of a Prosocial subscale, a Peer Problems subscale and three symptom subscales; Emotional Symptoms, Conduct Problems and Hyperactivity-Inattention. Each subscale consists of five items that are rated on a three-point-scale (0-1-2), adding up to a subscale-score ranging from 0–10. The scores on the subscales (excluding prosocial behaviours) may further be added into a Total Difficulties score, with a range from 0–40. The SDQ also includes an Impact scale, measuring distress to the child and the extent of which symptoms and problems interfere with the child's daily life [40]. Impact scales are included in both parent (five items, score range 0–10) and teacher (three items, score range 0–6) versions of the instrument.

A Child Protection Questionnaire (CPQ) developed for this study. This questionnaire assessed the placement history of the child, i.e. time in current foster home, age at first placement and number of previous placements.

Procedure

Data collection started on September 1st 2011, and lasted until the end of February 2012. The caseworker in the municipal child protection service received a postal letter with detailed information about the study and was asked to complete and return the CPQ to the principal investigator. Foster parents received a postal letter with detailed information about the study, and instructions on how to complete the SDQ online.

Ethics

The study was approved by the Regional Committee for Medical and Health Research Ethics in Western Norway. In accordance with Norwegian ethics requirements, children 12 years and older gave assent. According to Norwegian legislation, foster parents do not have the mandate to consent on behalf of their foster children. The study was therefore reviewed by the Ministry of Children, Equality and Social Inclusion, who provided caseworkers and foster parents with exemption from confidentiality for the current study.

Statistical methods

In estimating reliability of the five subscales in the SDQ, Stone and Otten [26] recommends the use of omega alpha coefficient (ω_h), based on a factor model with one factor, where ω_h relates to the hierarchical or general factor, as described in Mc Donald [41]. We employed the procedure as described in Stone, and calculated the reliability of each factor in the five-factor model.

Confirmatory factor analysis (CFA) based on data from foster parents was performed using Mplus 7.1 [42]. The CFA models were estimated using a robust weighted mean and variances adjusted least squares estimator (WLSMV) with DELTA parameterization, to account for the multivariate non-normality (Mardia's coefficient (61) of multivariate kurtosis, 705.392, $p < .001$; multivariate skewness, 101.626, $p < .001$) and the categorical data (ordinal data with three options). Using polychoric correlations for estimation, the WLSMV appear relatively robust to violations of normality [43, 44]. One influential outlier (Cook's $d = 1.65$) were identified, and removed prior to the CFA analyses, reducing sample size to $N = 236$.

Table 1. Factor loadings (standardized) for the modified^a five latent factors in the P-Strengths and Difficulties Questionnaire (N = 236).

	M (SD)	F1 Est (SE)	F2 Est (SE)	F3 Est (SE)	F4 Est (SE)	F5 Est (SE)
SDQ Emotional problems						
Somatic	0.44 (0.69)	.49 (.08)				
Worries	0.64 (0.73)	.78 (.05)				
Unhappy	0.56 (0.69)	.77 (.05)				
Clingy	1.00 (0.83)	.52 (.07)				
Afraid	0.80 (0.80)	.63 (.06)				
SDQ Conduct problems						
Tantrum	0.78 (0.78)		.81 (.04)			
Obey	0.80 (0.66)		.71 (.05)			
Fights	0.28 (0.55)		.74 (.05)			
Lies	0.82 (0.76)		.68 (.05)			
Steals	0.26 (0.56)		.66 (.06)			
SDQ Hyperactivity-/inattention						
Restless	0.90 (0.78)			.70 (.05)		
Fidgety	0.98 (0.80)			.84 (.04)		
Distracts	1.43 (0.74)			.72 (.06)		
Reflect	1.42 (0.64)			.74 (.05)		
Attend	1.32 (0.73)			.65 (.06)		
SDQ Peer problems						
Loner	0.54 (0.69)				.67 (.06)	
Friend	0.60 (0.76)				.51 (.07)	
Popular	0.59 (0.62)				.74 (.06)	
Bullied	0.57 (0.56)				.72 (.06)	
Oldbest	0.69 (0.78)				.74 (.05)	
SDQ Prosocial behaviors						
Considerate	1.19 (0.66)					.95 (.04)
Shares	1.37 (0.67)					.76 (.06)
Caring	1.41 (0.67)					.78 (.04)
Kind	1.74 (0.47)					.68 (.06)
Helpout	1.11 (0.71)					.42 (.07)

Note. Items in bold are reverse coded.

^a The modified model included correlations between (the error terms of) Fidgety and Restless ($r = .69$), Attend and Distracts ($r = .63$), Afraid and Clingy ($r = .57$).

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It was hypothesized that the data would fit a five-factor structure, corresponding to the five subscales. Indicators for the 5 factors are illustrated in Table 1. The fit of the CFA model was evaluated according to the following standard fit indices [45]: The Comparative fit index (CFI) is an incremental model fit index, with value ranging from 0 to 1. The Root Mean Square Residual (RMSEA) is an absolute index of fit and determines how well the hypothesized model fit the data. It is sensitive to the number of parameters in the model. The recommended cut-offs for good fit are $CFI \geq .95$, and $RMSEA < .06$ when using the WLSMV estimator [46].

To test whether the model was representative for both boys and girls we first tested the model separately for these two groups. In order to test for measurement invariance in factor loadings and thresholds across gender we used the automated Measurement Invariance routine for testing Configural, Metric (equal factor loadings) and Scalar invariance (equal factor

loadings and thresholds) between groups available in Mplus [47]. These traditional invariance analyses were followed up by testing whether potential local dependencies (correlated residuals), and associations between factors and means were invariant across gender. An adjusted chi-square test (DIFFTEST) was used to test whether the nested models differed significantly from each other as it is not proper to use a traditional $\Delta\chi$ test when using the WLSMV estimator [48]. The model was assumed non-invariant if the adjusted chi-square was significant and the change in CFI was < -0.002 [49].

Results

Mean Total Difficulties score was 15.21 (*SD* 7.90); 3.46 (*SD* 2.57) on Emotional subscale; 2.94 (*SD* 2.32) on Conduct subscale; 6.05 (*SD* 2.82) on Hyperactivity subscale; 2.76 (*SD* 2.31) on Peer problem subscale; 6.82 (*SD* 2.30) on Prosocial subscale; and 2.67 (*SD* 2.72) on the Impact scale. There were no missing values in the parent completed SDQs.

Internal reliability

The ω coefficients derived from the results of the CFA showed acceptable to high reliability for Emotional Symptoms (.78), Conduct Problems (.84), Hyperactivity-Inattention (.85), Peer Problems (.81), and Prosocial Behaviour (.85).

Confirmatory factor analyses

The original five-factor model showed an acceptable, but not excellent, fit to our data ($X^2 = 500.15$, $df = 265$, $p < 0.001$, CFI = 0.94, TLI = 0.93, RMSEA 0.06, 90% Confidence Interval [CI] [0.05, 0.07]). Modification indices suggested that model fit could be improved by accounting for some correlated error terms in items in the hyperactivity-/inattention factor (i.e. Fidgety with Restless, Attends with Distract) and in the emotional problems factor (Afraid with Clingy). The revised model showed an excellent fit to the data ($X^2 = 401.81$, $df = 262$, $p < 0.001$, CFI = 0.97, TLI = 0.96, RMSEA = 0.05, 90% CI [0.04, 0.06]). [Table 1](#) shows the factor loadings for the modified five latent factors in the SDQ, parent version.

[Table 2](#) shows the trait correlations between the five factors in the model. These were generally high ranging from (-).46 between Prosocial and Emotional problems to .84 between Hyperactive and Conduct. Polychoric correlations between items in the SDQ are included in [S1 Table](#). Even if the aim of the paper was to confirm the structural validity of the 5 factor solution in this sample of foster children, we also tested the fit of a 4 factor solution where the Hyperactivity and Conduct factors were treated as one factor due to their high correlation. The 4 factor solution had however a significantly poorer fit than the five factor solution ($\Delta X^2 = 13.158$, $\Delta df = 4$, $p < 0.05$).

Table 2. Correlations between latent factors of the Strengths and Difficulties Questionnaire (N = 236).

Factor	F1	F2	F3	F4	F5
F1 SDQ Emotional Symptoms	1.000				
F2 SDQ Conduct Problems	.72	1.000			
F3 SDQ Hyperactivity-Inattention	.70	.84	1.000		
F4 SDQ Peer Problems	.67	.79	.71	1.000	
F5 SDQ Prosocial	-.46	-.69	-.55	-.47	1.000

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Table 3. Testing Measurement Invariance of the Strengths and Difficulties Questionnaire factors across gender.

	Model development				Model comparison				
	df	Chi-square	CFI	RMSEA	Comparison	Δdf	ΔChi square*	p-value	ΔCFI
M1: Configural invariance	522	648.566***	0.966	0.045 (0.033–0.056)	-	-	-	-	-
M2: Metric invariance	542	663.121***	0.968	0.043 (0.031–0.054)	M2 versus M1	20	17.101	0.65	0.002
M3: Scalar invariance	562	690.120***	0.966	0.044 (0.031–0.055)	M3 versus M1	40	49.499	0.14	0.000
					M3 versus M2	20	32.230	0.04	-0.002
M4: Partial Scalar invariance [†]	560	681.638***	0.967	0.043 (0.030–0.054)	M4 versus M2	18	23.781	0.16	-0.001
M5: M4 + equal local dependencies	564	686.899***	0.967	0.043 (0.030–0.054)	M5 versus M4	4	6.487	0.17	0.000
M6: M5+ equal factors correlations [‡]	574	697.041***	0.967	0.043 (0.030–0.053)	M6 versus M5	10	14.345	0.16	0.000
M7: M6 + equal means [‡]	579	691.309***	0.970	0.040 (0.027–0.052)	M7 versus M6	5	3.062	0.69	0.003

Note.

[†] The thresholds of the Popular and Fights items were allowed to be freely estimated for boys and girl in this and the following models;

[‡] The residual covariance matrix was not positive definite in the girls group;

⁺ Tested using DIFFTEST in Mplus;

*** $p < .001$

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Measurement invariance analyses

The revised five-factor model was tested separately for boys and girls and had an adequate and very similar fit in both groups supporting that the five factor structure has an adequate fit to data for both sexes (boys, $n = 124$: $X^2 = 327.64$, $df = 262$, $p < 0.001$, TLI = 0.96, CFI = 0.97, RMSEA = 0.05, CI [0.03, 0.06]; girls, $n = 112$: $X^2 = 321.94$, $p < 0.001$, $df = 262$, TLI = 0.97, CFI = 0.97, RMSEA = 0.04, CI [0.02–0.06]). The remaining measurement invariance analyses are shown in Table 3.

The measurement invariance analyses supported scalar invariance, as the (adjusted) ΔX^2 between comparisons between the three first models was non-significant. None of the other model comparisons resulted in a statistically significant $\Delta\chi^2$, indicating that the size of the local dependencies, covariance between factors and factor means do not differ for boys and girls in this sample. A potential problem with the approach we have used for detecting measurement invariance, is that is based on model comparisons of a global fit measure (delta chi square) which in some situations might not be sensitive enough to detect local misspecifications. To locate such potential local misfits we examined whether any of the modification indexes of the scalar model (M3) were significant and had a standardized EPC (expected factor loading or threshold change) larger than 0.1. This search revealed that somatic symptoms might be more discriminative (stronger factor loading) and worries less discriminative for boys than girls with regard to Emotional symptoms factor. Steals might be somewhat more discriminative and fights less discriminative for girls compared to boys with regard to conduct problems. Finally, being popular might be more discriminative (and thus provide more information) for girls than boys with regard to peer problems. These local misfits are included as potential problems which have to be replicated by other studies before they are given any weight, as there is a high risk of capitalizing on chance given the low sample size in the present study, their explorative nature, and the very large number of parameters that have been tested.

Discussion

The findings in this study support the 5-factor structure of the SDQ when completed by foster parents of school-aged children. The fit of the original five factor model was acceptable, but could be improved by accounting for certain local dependencies (correlated error terms). Two

local dependencies within the hyperactivity/inattention factor were discovered. These local dependencies probably represent minor hyperactivity (“Fidgety” and “Restless”) and Inattention (“Attends” and “Distracts”) factors within the broader hyperactivity/inattention factor. Similar local dependencies (especially between “Fidgety” and “Restless”) within the hyperactivity/inattention factor have been found in several other studies [23, 25, 50–52]. These findings are in line with a growing number of studies that have found support for a bifactor model representation of ADHD symptoms [53]. This model hypothesizes that ADHD symptoms are best explained by both a general ADHD factor as well as domain specific factors related to hyperactivity/impulsivity and inattention. In the present study, a local dependency between the items “Afraid” and “Clingy” within the emotional problems factor was also discovered. This particular local dependency has been reported in at least two previous studies [23, 54] and we hypothesize it represents a more narrow anxiety factor within the broader emotional problems factor. Future CFA studies of the SDQ should in our opinion take these local dependencies into account to give a more complete representation of broad and narrow factors that have an impact on item responses.

The correlations between latent factors were generally rather large, and often larger than what have typically been reported in previous studies [55, 56]. In fact the correlation between the Conduct and the Hyperactivity factors nearly equals the often used cut off criterion ($r = .85$) for problematic discriminative validity [57]. The unusually large correlations between the factors in this study probably reflect the often high comorbidity of mental disorders in foster children [38]. And even if the correlation between Conduct and Hyperactivity is very large we believe that they should still be treated as two separate factors in future research as they have shown to show discriminant validity with respect to clinical disorder [54].

All the items had moderate to high factor loadings on their respective factors. Using the results from the modified CFA, reliability analyses indicated that all SDQ scales had an acceptable to very good reliability, as estimated by omega.

Overall, the 5 factor model was representative for both boys and girls when testing the model separately for the two groups.

To our knowledge, this is the first study examining the factor structure of the SDQ for foster parents. Therefore, our findings add substantially to the knowledge of the feasibility of SDQ as a screening measure in child protection services. Our findings strengthen the rationale for use of the SDQ in child protection services, where caregiver information may come from foster parents rather than biological parents. This is important, as information about child mental health may be difficult to obtain from biological parents in a child protection context.

Study limitations

There are several limitations to the study that need to be addressed. We did not obtain information on whether the foster parents in this study were kin to the child or not. As 26% of children placed in foster families during 2013 were placed in kin or close network [58], we must assume that a substantial proportion of the foster parents in this sample know the child from close family and social relation also before placement. This group may closely resemble biological parents in their knowledge of the children’s mental health and development.

The limited sample put restrictions on the forms of analyses possible. The power of the models in this study is rather low and the parameter to case ratio is as low as 1.34 (236/176) for the configural model. Therefore, results should be interpreted with caution.

Conclusions

The present findings support the use of the SDQ congruent with the suggested five-factor structure, also in child protection services. Together with previous findings of good predictive properties of the SDQ for school-aged foster children [30], these results indicate that SDQ may be used to screen foster children for mental health problems. Still, caution should be taken against using the SDQ as the sole instrument to screen for mental health and relational functioning, as the construct of Reactive Attachment disorder and Disinhibited Social Engagement Disorder seem salient in the description of these children's relational malfunctioning [59]. Further research is needed to gain more knowledge about how to best combine scales from screening instruments to adequately capture dimensions of psychopathology especially relevant for this high-risk group of children.

Supporting information

S1 Table. Polychoric correlation matrix between items in the SDQ.
(DOCX)

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Author Contributions

Conceptualization: SL TB KB.

Formal analysis: SL TB KB.

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Investigation: SL.

Methodology: SL TB KB.

Project administration: SL.

Resources: SL.

Supervision: SL.

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Visualization: SL TB KB.

Writing – original draft: SL TB.

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