Psychometric Properties and Confirmatory Structure of the Strengths and Difficulties Questionnaire in a Sample of Adolescents in Nigeria

Onoja M. Akpa[*], Rotimi F. Afolabi, Kayode R. Fowobaje

Department of Epidemiology and Medical Statistics, College of Medicine, University of Ibadan, Nigeria

Abstracts Though the SDQ has been used in selected studies in Nigeria, its theoretical structure has not been fully and appropriately investigated in the setting. The present study employs Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) to investigate the theoretical structure of the self-reported version of the SDQ in a sample of adolescents in Benue state, Nigeria. A total of 1,244 adolescents from different categories of secondary schools in Makurdi and Vandekya Local government areas of Benue state participated in the study. Preliminary data analyses were performed using descriptive statistics while the theoretical structure of the SDQ was assessed using EFA and CFA. Model fits were assessed using Chi-square test and other fit indices at 5% significance level. Participants were 14.19±2.45 (Vandekya) and 14.19±2.45 (Makurdi) years old. Results of the EFA and CFA revealed a 3-factor oblique model as the best model for the sample of adolescents studied (χ^2/df =2.20, p<0.001) with all fit indices yielding better results. A correlated 3-factor model fits the present data better than the 5-factor theoretical model of the SDQ. The use of the original 5-factor model of the SDQ in the present setting should be interpreted with caution.

Keywords Adolescents, Exploratory factor analysis, Confirmatory factor analysis, Strengths and difficulties questionnaire, Factor structure

1. Introduction

The Strengths and Difficulties Questionnaire (SDQ) developed by Goodman (1997) has often been used as a screening instrument for child and adolescent mental health and behavioral problems in clinical and public health investigations (Giannakopoulos, Tzavara, Dimitrakaki, Kolai- tis, Rotsika, & Tountas, 2009). With 25-item, the SDQ is used to generate scores for five domains of psychological adjustment among children and adolescents: hyperactivity-inattention, emotional symptoms, prosocial behavioral, conduct problems, and peer problems (Dickey & Blumberg, 2004; Goodman, 1997; Mellor & Stokes, 2007). The SDQ is generally considered to be an instrument with good psychometric properties and the construct validity has been supported in the literature (Björnsdotter, Enebrink, & Ghaderi, 2013; Dickey & Blumberg, 2004). For instance, the SDQ generated scores are highly correlated with Child Behavior Check List (CBCL) and it is significantly better than the CBCL in detecting inattention and hyperactivity when they both are compared to a semi-structured interview

(Björnsdotter et al., 2013; Dickey & Blumberg, 2004; Goodman and Scott, 1999). In addition, Dickey and Blumberg (2004) reported that significant relationships were observed between the SDQ self-report questionnaire and the Youth Self-Report. Besides, the SDQ contains several positively worded items assessing children's strengths similarly to that of the Youth Self-Report. The inclusion of these items increased the acceptability of the instrument to parents (Dickey & Blumberg, 2004).

Furthermore, as noted by Goodman (1999) and many other literatures (Björnsdotter et al., 2013; Dickey & Blumberg, 2004; Mellor & Stokes, 2007), there are several competitive advantages of the SDQ instrument over related instruments. Its brevity and free access features couple with its ability to focus not only on difficulties but also on strengths is exceptional, and the acceptability of the instrument to parents, mental health professionals, and epidemiologists is highly commendable. Apart from that, its adoption for and inclusion to use in institution such as the National Health Interview Survey in the United States (Dickey & Blumberg, 2004) is a great pointer to its potential.

Multi-informant SDQs have been found to be relatively good screeners for conduct, hyperactivity, depressive, and anxiety disorders in a community sample (Goodman, Ford, Simmons, Gatward, & Meltzer, 2000; Mullick & Goodman, 2001) in certain population setting. Exploratory and

* Corresponding author:
onojamatthew@gmail.com (Onoja M. Akpa)

confirmatory Factor Analysis has been previously used to assess the structure of the SDQ (Björnsdotter et al., 2013; Dickey & Blumberg, 2004; Giannakopoulos et al., 2009; Mellor & Stokes, 2007). However, the theoretical structure has not been fully and appropriately investigated (Mellor & Stokes, 2007) in some relevant population settings where the SDQ has been applied. In fact, though the SDQ has been used in some studies in Nigeria (Bakare, Ubochi, Ebigbo, & Orovwigho, 2010; Adeosun, Ogun, Adegbohun, Jejeloye, & Ogunlowo, 2014; Akpa & Bamgboye, 2015; Akpa, Bamgboye, & Baiyewu, 2015; Adeosun, Adegbohun, Jejeloye, Oyekunle, Ogunlowo, & Pedro, 2015), its theoretical structure and other psychometric properties have not been comprehensively investigated in the Nigerian setting.

To this end, the present study investigated the theoretical structure of the self-reported version of the SDQ in a population of adolescents attending secondary schools in Benue state, Nigeria. In addition to the theoretical structure, relevant hypothesis were tested using 6 other competing models. In order to ensure a more comprehensive report, both EFA and CFA including other relevant psychometric properties of the SDQ were also investigated. The intention was to provide scientific bases (back-up by data) as well as relevant cautions in the application of the SDQ in the Nigerian and similar settings.

2. Methods

Participants and Procedures

In 2012/2013, a state wide survey covering a Local Government Area (LGA) from each of the three Senatorial districts (including the state capital) was conducted in Benue state, Nigeria. The focus of the study was among others, to assess the psychosocial wellbeing of adolescents in the selected LGAs. Further details on the study location and sampling strategies have been described in previous studies (Akpa et al, 2015; Akpa & Bamgboye, 2015).

Participants were (684 boys and 560 girls) adolescents age 10-19 years (M = 14.7, SD =1.34) drawn from secondary schools, selected for large student's population, ownership (private or public) and gender (Boys-only, Girls-only and Gender-mixed). After reading through the consent form, every consenting student from a randomly selected class filled the self-administered questionnaire in the English language. In order to enhance the scope of the study findings, adolescents who are out of side were also captured through a household survey. Ethical approval for the survey was obtained from both the University of Ibadan Institutional Review Board (IRB) with the approval number UI/EC/12/0235 and the Benue state Ministry of Health's ethical committee with the reference number MED/261/VOL.1/56. Further permission was obtained from the authorities of each selected school prior to the conduct of the study. The school principals or designated officers of the institutions stood in as guardians for the participants (Akpa

et al, 2015; Akpa & Bamgboye, 2015).

Table 1.   Socio-demographic characteristics of respondents

Variable	Vandekya (%) n=738	Makurdi (%) n=507
Age		
10-12 years	124(16.8)	16(3.2)
13-17 years	495(67.1)	436(86.0)
18-19 years	44(6.0)	31(6.1)
Not Reported	75(10.2)	24(4.7)
Gender		
Male	359(48.6)	325(64.1)
Female	378(51.2)	182(35.9)
Not Reported	1(0.1)	
Religion		
Christianity	723(98.0)	458(90.3)
Islam	13(1.8)	43(8.5)
Not Reported	2(0.2)	6(1.2)
Place of residence		
Rural Area	386(52.3)	140(43.6)
Urban Area	331(44.9)	315(62.1)
Not Reported	21(2.8)	52(10.3)
Tribe		
TIV	615(83.3)	221(43.6)
Idoma	14(1.9)	100(19.7)
Igede	8(1.1)	17(3.4)
Others	96(13.0)	162(32.0)
Not Reported	5(0.7)	7(1.4)

For the present analysis, data for the State capital (325 boys and 182 girls) and one randomly selected (Vandekya) LGA (359 boys and 378 girls) was extracted from the database. The combined data consisted of 54.98% boys and 45.02% girls aged 10-19 years (M = 14.7, SD = 1.34).

Measures

The SDQ includes 25 items for measuring behavior and emotional problems among children and adolescents (Doku, 2009; Goodman, 1997; Mullick & Goodman, 2001; Zhou, 2012). Already translated into over 60 languages, the SDQ has been used to assess children's psychosocial outcomes in over 40 countries (Akpa et al., 2015; Doku, 2009, Giannakopoulos et al., 2009). The SDQ items were initially selected and reported in a previous study (Goodman, 2001), on the basis of relevant concepts as well as factor analysis. The SDQ is a multimethods instrument consisting of a parent and a teacher form available for children aged 3–16 years, and a self-reported form available for the age 11-16 years.

In general, each version of the SDQ contains 25 items divided into five subscales of five items, namely; Emotional Symptoms Scale (ESS), Conduct Problems Scale (CPS), Hyperactivity-Inattention Scale (HAS), Peer Problems Scale (PPS), and Prosocial Behavior Scale (PBS). Items are scored on a 3-point Likert-type scale indicating how each attribute applies to the responded (0=not true, 1=somewhat true,

2=certainly true). A high score on the PBS reflects strength, while high scores on the other four subscales of the SDQ reflect difficulties. Subscale total scores are summed (for all subscales except (PBS) together to generate the Total Difficulties score (TDS). Possible total scores ranges from 0 to 10 for subscales and from 0 to 40 for the TDS with varying cut-off scores for distinguishing normal, borderline, and abnormal symptoms.

Statistical Analysis

Preliminary analysis of the responses at the item level was carried out to assess pattern of responses and the rate of missing values in the data. Participants who deliberately left a large proportion of the questionnaires unfilled and those found to endorse the same response for all items in the questionnaire were completely removed from the database prior to analysis (resulting in a 0% missing values).

Table 2. Response distribution and descriptive characteristics at item level

Code	Questionnaire Item	Not True (%)	Somewhat True (%)	Certainly True (%)	$\overline{X}$	S^2	γ_S	γ_K
	Emotional symptoms scale (ESS)							
Q03	I get a lot of headaches, stomach-aches or sickness.	52.85	39.04	8.11	.55	.64	.73	-.49
Q08	I worry a lot.	39.52	44.34	16.14	.77	.71	.37	-.97
Q13	I am often unhappy, down hearted or tearful.	50.60	40.72	8.67	.58	.65	.67	-.57
Q16	I am nervous in new situations. I easily lose confidence.	37.08	49.04	13.88	.77	.67	.31	-.83
Q24	I have many fears, I am easily scared.	31.65	50.60	17.75	.86	.69	.19	-.90
	Conduct Problems Scale (CPS)							
Q05	I get very angry and often lose my temper.	30.76	51.41	17.83	.87	.69	.17	-.88
Q07	I usually do as am told*.	35.74	55.18	9.08	.73	.61	.23	-.61
Q12	I fight a lot. I can make other people do what I want.	70.60	22.49	6.91	.36	.61	1.46	1.00
Q18	I am often accused of lying or cheating.	52.45	34.46	13.09	.61	.71	.73	-.71
Q22	I take things that are not mine from home, school or elsewhere.	64.42	28.19	7.39	.43	.63	1.17	.25
	Hyperactivity-Inattention Scale (HAS)							
Q02	I am restless; I cannot stay still for long.	45.54	40.48	13.98	.68	.70	.53	-.87
Q10	I am constantly fidgeting or squirming.	43.78	45.78	10.44	.67	.66	.48	-.73
Q15	I am easily distracted; I find it difficult to concentrate.	36.06	51.57	12.37	.76	.65	.29	-.74
Q21	I think before I do things*.	49.64	41.04	9.32	.60	.65	.64	-.61
Q25	I finish the work am doing. My attention is good*.	47.15	44.42	8.43	.61	.64	.55	-.64
	Peer Problem Scale (PPS)							
Q06	I am usually on my own. I generally play alone or keep to myself.	46.10	41.85	12.05	.66	.68	.55	-.78
Q11	I have one good friend or more*.	46.35	39.20	14.46	.68	.71	.55	-.89
Q14	Other people of my age generally like me*.	40.72	49.56	9.72	.69	.64	.38	-.70
Q19	Other children or young people pick on me or bully me.	51.49	37.35	11.16	.60	.68	.71	-.64
Q23	I get on better with adults than with people my own age.	31.33	48.19	20.48	.89	.71	.16	-1.0
	Prosocial Behavior Scale (PBS)							
Q01	I try to be nice to other people. I care about their feelings.	6.67	42.33	51.00	1.44	.62	-.64	-.54
Q04	I usually share with others (food, game, pen etc).	9.24	44.58	46.18	1.37	.65	-.53	-.67
Q09	I am helpful if someone is hurt, upset or feeling ill.	14.22	44.26	41.53	1.27	.70	-.43	-.89
Q17	I am kind to younger children.	9.96	37.03	53.01	1.43	.67	-.75	-.54
Q20	I often volunteer to help others (parents, teachers, children).	10.84	45.94	43.21	1.32	.66	-.46	-.74

$\overline{X}$ - Mean; S^2 - Standard deviation; γ_S - Skewness; γ_K - Kurtosis

Note: Pattern matrix coefficients with values of .40 or greater are bolded

Descriptive statistics including mean, standard deviations and percentages were used to describe the distributions of the respondents, SDQ subscales and items. The Pearson's moment correlation coefficient was used to assess the strength of the interrelationships between the subscales of the SDQ. Cronbach's Alpha (α) was used to assess the internal consistency of the instrument. Given the ordinal nature of the response format (3 points only), Polychoric ordinal alpha (α_p) (Gadermann, Guhn, & Zumbo, 2012) was calculated to further investigate the estimates of the internal consistency obtained using Cronbach's alpha. Polychoric correlations between the items in each subscale were first obtained from R package (Fox, 2010). The average correlation ($\overline{\rho}$) was entered into the following formula (Björnsdotter et al., 2013; Gadermann et al., 2012), where k is the number of items in the scale:

$$\alpha_p = \frac{k\overline{\rho}}{\left[1+\left(k-1\right)\overline{\rho}\right]}$$

Using the data extracted for Vandekya LGA, two Exploratory Factor Analyses (EFA) were conducted using IBM SPSS Statistics, version 20. The first was to assess the SDQ measurement model and how each item loaded onto their respective subscales and the other was to investigate the EFA model suggested by the data. Prior to EFA, the Kaiser-Meyer-Olkin measure of sampling adequacy and the Bartlett's test of sphericity were conducted to indicate if the data were appropriate for EFA (Akpa et al., 2015; Liau, et.al, 2011; Pinterits et.al, 2009). Exploratory Factor Analysis was conducted using Principal-axis factoring extraction with a direct oblimin rotation. The factor pattern coefficients for the SDQ items were computed along with their communalities, eigenvalues and the percentage of variance explained by the extracted factors. In the second EFA, the scree plot, eigenvalues, the factor pattern coefficients, and the percentage of variance explained by the extracted factors were used to determine the number of factors that best fits the data. Items should preferably load ≥0.40 (in absolute value) on the relevant factor and <0.40 on all other factors (Akpa et al., 2015; Liau et.al, 2011; Yang & Montgomery, 2011).

Subsequent on the outcome of the first EFA, the fit of the Goodman's (five factors) theoretical model of the SDQ (5-factor) was investigated using series of confirmatory factor analysis (CFA) models in AMOS version 21. The Goodman's (5-factor) theoretical model of the SDQ was tested against a 5-factor orthogonal model; a one-factor model having all 25-items loading on a single factor and a 5-factor second-order model having all factors (except the Prosocial Behavior scale) subordinated to a single second-order factor. Consequent on the outcome of the second EFA, another series of CFA models of the SDQ was

also investigated. A 3-factor oblique model, a 3-factor orthogonal model and a 3-factor second-order model having the first two factors (consisting of only items from the four subscales constituting difficulties) subordinated to a single second-order factor model were investigated.

In each CFA model, multiple indices and their respective cut-off were used to evaluate the global model fit to the data. In particular, the Chi-square test divided by the degrees of freedom (df) should be less than 3 ($\chi^2/df < 3$) and the Root Mean Square Error of Approximation (RMSEA) is ≤ 0.06. The Goodness of Fit Index (GFI), the Tucker-Lewis Index (TLI), the Comparative fit index (CFI), the Incremental Fit Index (IFI) is greater than 0.8 while the Normed Fit Index (NFI) is greater than 0.7. Also, the Consistent AIC (CAIC), the Bayesian Information Criterion (BIC) and the Expected Cross Validation Index (ECVI) were as well used for model comparisons, with smaller values indicating a better fit (Akpa et al., 2015; Akpa & Unuabonah, 2011; Yang & Montgomery, 2011). All analysis was carried out at 95% confidence level.

3. Results

Participants' characteristics

Participants were 14.19±2.45 years in Vandekya LGA and 14.19±2.45 years in Makurdi LGA (results not in Tables) with 67.1% and 86.0% of them being age 13-17 years in Vandekya and Makurdi LGAs respectively. More than half of the participants in Vadekya LGA are female while over 60% of them in Makurdi LGA are male (Table 1).

More than half (52.3%) of the participants in Vandekya LGA live in the rural areas while 62.1 % in Makurdi LGA indicated that there reside in urban areas. Majority (83.3%) of the participants in Vandekya LGA are TIV (the major ethnic group in Benue state, Nigeria), 1.9% are Idoma while 13.0% of them are from other ethnic groups such as Igala, Urobho, Hausa, Igbo, etc. On the other hand, while 43.6% of the participants in Makurdi LGA are TIV, 19.7% are Idoma and 32.0% of them are from other ethnic groups (Table 1).

Item level responses and Descriptive statistics

Analysis of the responses at the item level showed low (between 6.9% and 20.5%) endorsement for certainty of experiencing each item in the subscales of the SDQ, except for the prosocial behavior were endorsement for the items ranged from 41.5% to 53.0%. Items mean scores ranged from 0.36±0.61 to 1.44±0.62 with *"I fight a lot"* and *"I try to be nice to other people"* recording the lowest and the highest mean scores respectively. All items showed very low estimates of skewness and kurtosis; in particular, skewness ranged from -0.64 to 1.46, while kurtosis ranged from -1.0 to 1.0.

Table 3. Communalities, Pattern Matrix for the Theoretical 5-Factor structure of the SDQ

Code	Questionnaire Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	h^2
Emotional symptoms scale (ESS)							
Q03	I get a lot of headaches, stomach-aches or sickness.						.20
Q08	I worry a lot.	**-.56**					.35
Q13	I am often unhappy, down hearted or tearful.	**-.41**					.32
Q16	I am nervous in new situations. I easily lose confidence.	**-.63**					.39
Q24	I have many fears, I am easily scared.	**-.50**					.29
Conduct Problems Scale (CPS)							
Q05	I get very angry and often lose my temper.	**-.42**					.24
Q07	I usually do as am told*.			**.52**			.35
Q12	I fight a lot. I can other people do what I want.		**.55**				.35
Q18	I am often accused of lying or cheating.		**.44**				.30
Q22	I take things that are not mine from home, school or elsewhere.		**.56**				.37
Hyperactivity-Inattention Scale (HAS)							
Q02	I am restless; I cannot stay still for long.						.34
Q10	I am constantly fidgeting or squirming.						.19
Q15	I am easily distracted; I find it difficult to concentrate.	**-.61**					.34
Q21	I think before I do things*.			**.50**	**.45**		.56
Q25	I finish the work am doing. My attention is good*.			**.55**			.40
Peer Problem Scale (PPS)							
Q06	I am usually on my own. I generally play alone or keep to myself.						.20
Q11	I have one good friend or more*.			**.47**			.28
Q14	Other people of my age generally like me*.			**.59**			.39
Q19	Other children or young people pick on me or bully me.		**.56**				.32
Q23	I get on better with adults than with people my own age.						.18
Prosocial Behavior Scale (PBS)							
Q01	I try to be nice to other people. I care about their feelings.					**.47**	.41
Q04	I usually share with others (food, game, pen etc).					**.60**	.44
Q09	I am helpful if someone is hurt, upset or feeling ill.					**.60**	.35
Q17	I am kind to younger children.					**.66**	.48
Q20	I often volunteer to help others (parents, teachers, children).					**.53**	.39
	Eigen values	*4.77*	*1.25*	*1.39*	*1.02*	*3.29*	
	% Variance explained	*19.08*	*4.98*	*5.57*	*4.08*	*13.14*	

Note: Pattern matrix coefficients with values of .40 or greater are bolded

Descriptive statistics, Inter-relationship and internal consistency of measures

Using data from Vandekya LGA (n=738), mean score on the five subscales of the SDQ ranged from 2.95±1.98 (for the Emotional Symptoms Scale) to 7.04±2.18 (for the Prosocial Behavior Scale) while the overall mean Total difficulties score was 14.82±6.081. Higher scores on Emotional symptom were significantly correlated with higher scores on all other subscales (P<0.001) except for the Prosocial Behavior scale. Also, higher scores on PBS were significantly correlated with lower scores on all subscales (P<0.001) except the Emotional symptoms scale. The internal consistency of the SDQ (both Cronbach's and polychoric ordinal alphas) was within acceptable range, except for Cronbach's alpha for the Peer problems scale (α=0.46). Specifically, Polychoric ordinal alpha ranges from 0.71 (for the Peer problems scale) to 0.85 (for the Prosocial Behavior Scale) (Table 5).

On the order hand, using data from Makurdi (n=507), mean score on the three factors extracted for the SDQ were 8.19±4.93 (Factor 1), 2.71±1.78 (Factor 2) and 5.50±1.83 (Factor 3). Higher scores on Factor 1 were significantly

correlated with higher and lower scores on Factors 2 respectively (r=0.44; P<0.001) while higher scores on Factor 2 were significantly correlated with lower scores on Factor 3 (r=-0.10; P<0.001). The internal consistency (both Cronbach's and polychoric ordinal alphas) for the three factors were within acceptable range (Table 5).

Exploratory factor Analysis

Results from the first exploratory Factor Analysis show five factors with eigen-values greater than 1 (Fcator 1: 4.77, Factor 2: 1.25, Factor 3: 1.39, Factor 4: 1.02 and Factor 5: 3.29) and accounted for a total of 42.57% of the variance in the SDQ scores. The standardized regression coefficients (or factor loading) between each item and each factor derived from the Principal axis-factoring with an oblique rotation of

the five factors are given in Table 3. To ease interpretability, coefficients with an absolute value < 0.4 are omitted. The results of the EFA revealed that the rotated extracted communalities show low to moderate estimates of the variance in each variable accounted for by the factors in the factor solution. Also, only the prosocial behavior subscale was completely identified by the items theoretically intended to represent it. Other subscales including the emotional symptoms scale, hyper-activity-inattention scale, peer problem scale and the conduct problems scale were not identified by some items theoretically intended to represent those domains (Table 3). In general, factors assumed to present the domains were represented by fewer than the intended five items.

Table 4. Communalities, Pattern Matrix of the 3-Factor (oblique) structure of the SDQ

Question code	Item	Factors 1	2	3	h^2
Q02	I am restless; I cannot stay still for long.	**.58**			.34
Q08	I worry a lot.	**.54**			.31
Q13	I am often unhappy, down hearted or tearful.	**.51**			.33
Q12	I fight a lot. I can other people do what I want.	**.49**			.28
Q15	I am easily distracted; I find it difficult to concentrate.	**.48**			.26
Q18	I am often accused of lying or cheating.	**.48**			.27
Q16	I am nervous in new situations. I easily lose confidence.	**.47**			.31
Q05	I get very angry and often lose my temper.	**.46**			.21
Q22	I take things that are not mine from home, school or elsewhere.	**.46**			.27
Q24	I have many fears, I am easily scared.	**.44**			.26
Q03	I get a lot of headaches, stomach-aches or sickness.	**.43**			.20
Q06	I am usually on my own. I generally play alone or keep to myself.	**.42**			.19
Q19	Other children or young people pick on me or bully me.	**.40**			.20
Q17	I am kind to younger children.		**.59**		.45
Q20	I often volunteer to help others (parents, teachers, children).		**.55**		.38
Q04	I usually share with others (food, game, pen etc).		**.54**		.42
Q09	I am helpful if someone is hurt, upset or feeling ill.		**.48**		.31
Q14	Other people of my age generally like me*.			**.63**	.40
Q07	I usually do as am told*.			**.58**	.36
Q25	I finish the work am doing. My attention is good*.			**.51**	.37
Q11	I have one good friend or more*.			**.47**	.26
Q10	*I am constantly fidgeting or squirming.*				.14
Q21	*I think before I do things*.*				.39
Q23	*I get on better with adults than with people my own age.*				.15
Q01	*I try to be nice to other people. I care about their feelings.*				.38
	Eigen values	*4.77*	*3.29*	*1.39*	
	% Variance explained	*19.08*	*13.14*	*5.57*	

Note: Pattern matrix coefficients with values of .40 or greater are bolded while items loading on no factor are highlighted in italics

Table 5. Factor Correlations, Descriptive statistics and Reliabilities coefficients of the 5 Subscales and 3-factor model of the SDQ

	ESS	CPS	HAS	PPS	Factor 1	Factor 2	M	SD	α	$α_p$	Reliabilities in Literature	
											$α_p$	α
Existing subscales of the SDQ												
ESS							3.37	2.21	.637	.839	0.75[1], 0.89[2]	0.65[3,4]; 0.73[5]
CPS	.959*						2.95	1.98	.546	.788	0.72[1], 0.89[2]	0.52[3,4]; 0.56[5]
HAS	.898*	.931*					3.17	2.01	.548	.776	0.71[1], 0.89[2]	0.53[3]; 0.59[4]; 0.63[5]
PPS	.803*	.830*	.773*				3.54	2.00	.463	.708	0.74[1], 0.85[2]	0.44[3]; 0.52[4]; 0.50[5]
PBS	.002	-.303*	-.196	-.376*			7.04	2.18	.655	.854	0.84[1], 0.91[2]	0.69[3]; 0.68[4]; 0.72[5]
3-facor Model of the SDQ												
Factor 1							8.19	4.93	.810	.972		
Factor 2					.437*		2.71	1.78	.555	.731		
Factor 3					-.632	-.101*	5.50	1.83	.587	.762		

Note: * significant correlations (p< .001), α = Cronbach's Alpha, $α_p$ = Polychoric Ordinal Alpha
[1] Ortuno-Sierra et al. (2015); [2]Björnsdotter et al., 2013; [3]Akpa & Bamgboye (2015); [4]Akpa et al. (2015); [5]Giannakopoulos et al. (2009)

Table 6. Summary of Fit Indices of the Confirmatory Factor Analyses

Models	x^2	df	GFI	NFI	IFI	TLI	CFI	RMSEA	BIC	CAIC	ECVI
5-Factor (oblique) Model	804.76	265	.874	.673	.754	.717	.750	.063	1178.47	1238.47	1.828
5-Factor (orthogonal) Model	1446.14	275	.785	.413	.465	.406	.459	.092	1757.56	1807.56	3.056
1-Factor (Unidimensional) Model	1125.30	275	.803	.543	.611	.571	.607	.078	1436.73	1486.73	2.422
3-Factor (oblique) Model	**408.87**	**186**	**.930**	**.788**	**.872**	**.854**	**.871**	**.049**	**689.15**	**734.15**	**.986**
3-Factor (orthogonal) Model	531.07	189	.912	.725	.804	.779	.801	.060	792.66	834.66	1.216
5-Factor 2nd order Model	840.81	270	.866	.659	.740	.707	.736	.065	1183.37	1238.37	1.879
3-Factor 2nd order Model	610.56	188	.911	.684	.758	.726	.755	.067	878.39	921.39	1.377

Note: x^2 =Chi-square statistics; df=degree of freedom; GFI=Goodness-of-Fit index; NFI=Normed-fit index; IFI=Incremental fit indices; TLI=Tucker-Lewis index; CFI=Comparative fit index RMSEA= Root Square Means Error of Approximation; BIC=Bayesian information criterion; CAIC=Consistent Akaike information criterion; ECVI= Expected cross-validation index.

Specifically, one of the items ("I got a lot of headache, stomach-aches or sickness") intended to represent emotional symptom scale had <0.40 loading on factor 1 assumed to represent the domain. The anger and attention deficit items which were respectively intended to relate to the conduct problem and hyperactivity domains loaded on factor 1 instead. Items intended to relate to the conduct problems scale were scattered across three different factors (factor 1, 2 and 3) with three of the items (fighting, lying and stealing) loading >0.40 on factor 3 alone. Although two items intended to relate to each of the peer problems and hyperactivity loaded >0.40 on factor 3 alone, some of the items intended to relate to these domains did not load on any factor at all while others loaded on more than one factor (Table 3). The fourth extracted rotated factor had only one item ("I think before I do things") crossing loading on it from the five items intended to relate to hyperactivity-inattention.

Confirmatory factor Analysis

The results of the seven competing CFAs and estimates of

the fit indices confirmed the structure identified by the second EFA (3-factor oblique model) as the best model for the sample of adolescents studied. The estimated correlation between the latent variables as well as the standardized path coefficients for the 3-factor model were all statistically significant and salient ->0.35 (Akpa, et al., 2015; Liau et.al, 2011) except for the low correlation coefficient between Factor 2 and Factor 3 (Figure 1). The overall model goodness of fit resulted in an excellent fit ($χ^2$/df = 2.20, p < .001). The RMSEA for the 3-factor solution was 0.049, which is approximately equal to the cut-off value of 0.05 and indicated a relatively good fit of the factor model to the data (Akpa, et al., 2015; Liau, et al., 2011; Yang & Montgomery, 2011). The GFI was 0.930, which also indicates relatively good fit (Akpa, et al., 2015; Liau, et al., 2011; Yang & Montgomery, 2011). Also, estimate of the CAIC for the 3-factor oblique model was 734.15 (the lowest of the seven CFA models fitted to the data) and indicated that the model was better than all other competing models in the analysis (Table 5).
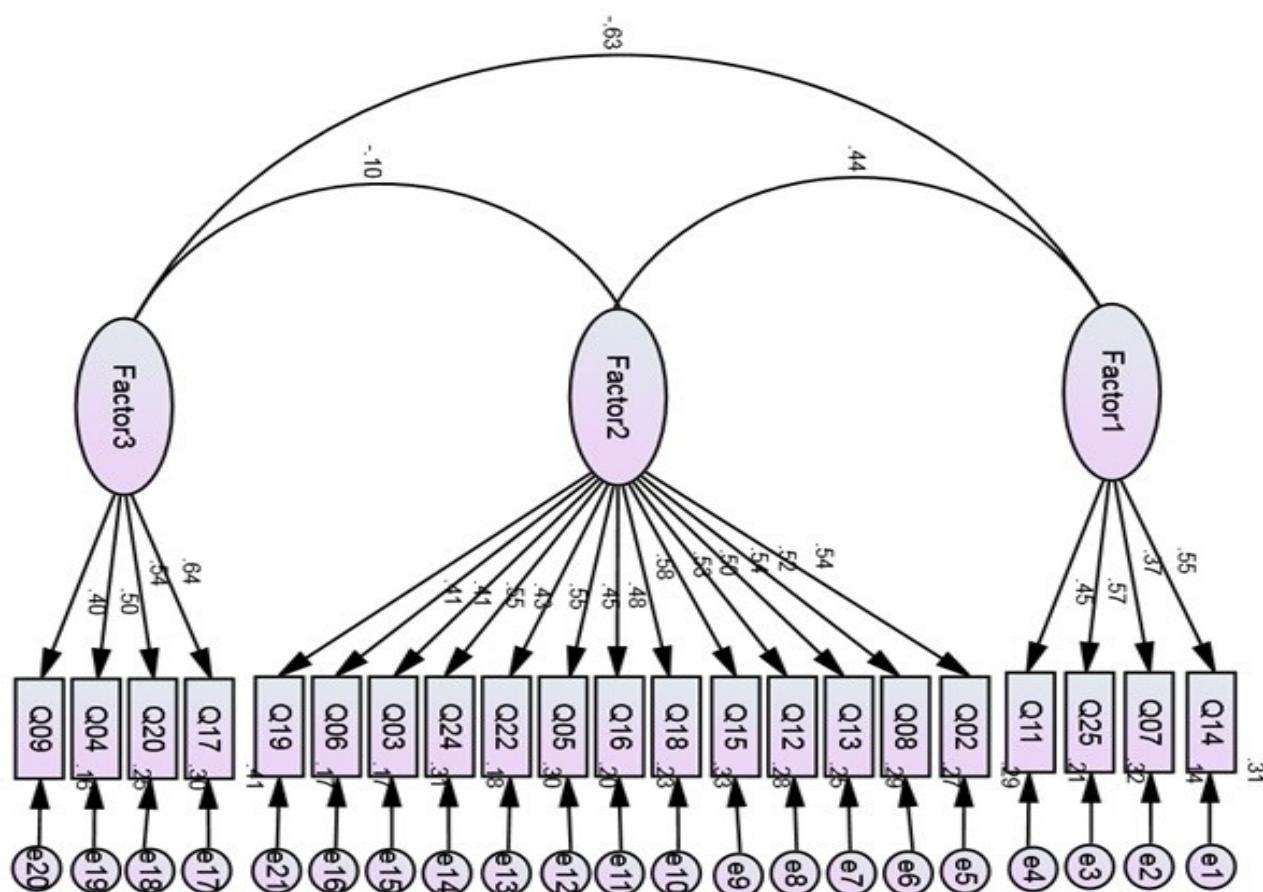
Figure 3.   Standardized estimates for the competing 3-factor (21-item SDQ)

On the other hand, the CFA of both the theoretical 5-Factor oblique and 5-Factor orthogonal models revealed poor fits. With a χ^2/df exceeding 3.0 (χ^2/df = 3.04: 5-factor oblique and χ^2/df = 52.20: 5-factor orthogonal), the overall goodness of fit of the either models of the theoretical dimensions of the SDQ were poor. The RMSEA for the 5-factor solutions were above the cut-off value of 0.05 (RMSEA=0.063 for the 5-factor oblique and RMSEA=0.092 for the 5-factor orthogonal), and indicated poor fits of the factor models to the data (Akpa, et al., 2015; Liau, et al., 2011; Yang and Montgomery, 2011). The GFI was below the cut-off limit of 0.90 for both models (GFI=0.874: 5-factor oblique and GFI=0.785: 5-factor orthogonal), which also indicate relatively poor fit. In addition, estimate of the CAIC for the 5-factor models (CAIC=1238.47: 5-factor oblique and CAIC=1807.56: 5-factor orthogonal) were among the worst in the seven CFA models fitted in the present analysis (Table 5).

4. Discussion

The strength and difficulty questionnaire (SDQ) was designed, as both clinical and epidemiological research tool, to investigate children and adolescent's attention or concentration, peer relations, prosocial behaviors, emotional symptoms and conduct or behavioral disorders (Akpa, et al.,

2015; Dickney & Blumberg, 2004; Goodman, 1994; 1997). In the present study, we present a comprehensive report on the factor structure of the SDQ in a sample of adolescents (age 10-19 years) in Nigeria. Other psychometric properties of the SDQ including the Cronbach's and the polychoric alphas (investigating the internal consistency of the instrument) were presented for each subscale of the SDQ. We also reported results for seven different CFA models as well as item response analysis that explicitly described the distribution properties of the SDQ items.

Thought all items have skewness and kurtosis within acceptable range (-2 to +2) for normality assumptions, polychoric ordinal alphas in addition to the Cronbach's alpha was used to investigate internal consistency due to the ordinal nature of the response scores. The internal consistency of the SDQ theoretical measurement (5-factor) model using Cronbach's alpha was found to be relatively good (except for the Peer problems scale). And using the Polychoric alpha, the internal consistency was found to be high for all subscales. This suggests that the Cronbach's alpha may have under estimated the reliability coefficient due to the ordinal nature of the response scores. However, even the estimate obtained using the polychoric alpha is slightly lower compare with the reported value obtained for the SDQ subscales in former studies (Bjornsdotter et al., 2013; Giannakopoulos et al., 2009; Mellor & Stokes, 2007;

Stone et al., 2010). Estimate of the internal consistencies observed in the present study notwithstanding, the pattern of results is somewhat similar to what was previously reported in related studies. Specifically, the Peer problems scale has the weakest reliability while the Prosocial behavior scale has the strongest reliability coefficient (Bjornsdotter et al., 2013; Giannakopoulos et al., 2009; Mellor & Stokes, 2007; Stone et al., 2010).

The theoretical measurement (5-factor) model of the SDQ has been supported in part by selected studies. D'Acremont and Linden (2008) reported a reliable factor organization of the French version of the teacher-report version of the SDQ with estimate of the internal consistency ranging from acceptable (0.64) to very good (0.90) reliability for the five subscales. Also, among parents and teachers in a community sample of young children in Flanders, Netherland, van Leeuwen, Meerschaert, Bosmans, De Medts, & Braet (2006) reported that the five-factor model of the SDQ as outlined by Goodman fitted moderately well, whereas the model with three latent variables (externalising behavior, internalising behavior, and prosocial behavior) did not show better fit indices. Apart from that, related studies have also provided support for the Goodman's five-factor structure via confirmatory factor analytic techniques (Capron, Therond, & Duyme, 2007; Giannakopoulos et al., 2009; Muris et al., 2003; Smedje, Broman, Hetta, & von Knorring, 1999). In a sample of 1,194 school children, Giannakopoulos et al. (2009) suggested that the original component scales of the SDQ, as described by Goodman, may be appropriate for a sample of Greek adolescents. However, a scoring procedure that better reflects some modifications in the factor structure of the instrument was suggested in order to improve the ability of school practitioners and clinicians to screen for emotional and behavioral problems among Greek adolescents.

Unfortunately, when a confirmatory factor analysis was used, the 5-factor model does not provide suitable indices to support a good fit in the present study. Although the internal consistency for the five-factor model shows promise, a correlated 3-factor model appears to fit the behavioral pattern of adolescents in the present setting better compared to a 5-factor model. Not only was the 5-factor model not reproduced in the present study, only the prosocial behavior (Factor 2 in Table 4) was relatively stable with one item "*I try to be nice to other people. I care about their feelings*" intended for the subscale not loading on any factor. The remaining two extracted factors had items from the SDQ subscales loading on them haphazardly but one of the factors (Factor 1 in Table 4) comprised of all items in the emotional symptom scale and other selected (internalising) items from conduct problems and inattention. The other factor (Factor 3 in Table 4) contains few externalising items such as *"I usually do as am told" etc* and is more related to externalising problems. Although reasons for such loading pattern are unclear, it is possible that some studies reproduced the 5-factor model because of the similarities in settings between the study areas and where the SDQ scale was constructed.

Many other past studies (even in similar settings) have been unable to reproduce the 5-factor model when the SDQ was administered to study subjects. For instance, in previous research examining the factor structure of the SDQ with children aged 6 to 10 years (in the UK) and adolescents ages 4 to 17 years (in the USA), the predicted five-component structure was not entirely confirmed. Among children aged 6 to 10 years, Curvis, McNulty, & Qualter (2014) found that a correlated two-factor structure comprising of 'externalizing and peer problems' and 'internalizing problems' fit the data well and identified two-factor model mapped broadly onto the constructs of externalizing and internalizing behavior.

On the other hand, among adolescents studied in the USA, the results of both exploratory and confirmatory factor analysis show a distorted items loading pattern. Some items intended to assess conduct problems loaded more on the hyperactivity, and some items intended to assess peer problems were more strongly related with emotional or prosocial problems (Dickey & Blumberg, 2004). Also, Dickey & Blumberg (2004) found that a stable three-factor model consisting of externalization problems, internalization problems, and a positive construal factor. In the present study however, though a three-factor model was obtained, the distortion in the items loading pattern grossly affected the stability of factors, except for the prosocial construct. Worse results than those of the present investigations have been obtained for SDQ in an earlier study conducted in Australia (Mellor & Stokes, 2007). Using the parent and teachers' versions of the SDQ in a large community sample of 7–17 years-olds, Mellor and Stokes (2007) found that the reputed 5-factor structure of the SDQ was not supported and none of the subscales was unidimensional. It is important to note that these results may not be unrelated to differences in the way SDQ items are construed by respondents from different settings (Akpa et al., 2015; Dickey & Blumberg, 2004).

However, it is hasty to conclude that these findings invalidate the use of the SDQ in the present setting. In the first place, the instrument is designed for use as a screening tool, rather than a diagnostic test, and its validity has been documented in several study settings with different study populations (Goodman et al., 2000; 2003; Klasen, Woerner, Wolke et al., 2000; Mellor & Stokes, 2007; Muris, Meesters, & van den Berg, 2003). Consequently, rather than suggesting modifications, Mellor and Stokes (2007) suggested that the SDQ should be used cautiously, within the confines of its intent.

5. Strength and Limitations

Though the SDQ has been used to investigate behavioral problems among adolescents in selected studies originating from Nigeria (Adeosun, et al., 2014; Adeosun et al., 2015; Akpa & Bamgboye, 2015; Akpa et al., 2015; Bakare et al., 2010), the present study is, to the best of our knowledge, the first comprehensive attempt to report the factor structure of the SDQ in this setting. The inclusion of the polychoric alpha

and the CFA in the present study is a further step on what may have been reported in some important studies on the SDQ. Notwithstanding, the study suffers some important limitations worth reporting. For instance, when the SDQ's self reported and parent/teacher's reported versions are used together in a study, it allows from comparison of results as well as assessment of convergence and discriminant validity. The use only the self-reported version of the SDQ in the present study is an important limitation. A part from that, a study covering at least a state from each of the six geopolitical zones of Nigeria would have provided a more robust and report with wider applicability.

6. Conclusions and Recommendations

The present study is the first to provide data on the factor structure and psychometrics properties of the self reported version of the SDQ in Nigeria. The 5-factor theoretical model of the SDQ does not fit the data obtained from the present study; a correlated 3-factor model fits the data better. Except for the prosocial behavior, none of the original subscale of the SDQ is unidimensional in the present study. The results suggest that in the present settings, the items on the SDQ may not provide a good fit to the reputed 5 subscales of its measurement model. It is therefore suggested that the use of the original 5-factor model of the SDQ in the present setting be interpreted with caution.

However, further large factor analytic studies are needed in the setting in order to accurately identify an alternative structure that would force a rearrangement of items onto alternative subscales that better represent the situations of adolescents in this area (Mellor & Stokes, 2007).

ACKNOWLEDGEMENTS

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