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Psychometric properties of the Strengths and Difficulties Questionnaire³⁻⁴ in 3-year-old preschoolers

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Abstract

We provide the first validation data on the Strengths and Difficulties Questionnaire (SDQ³⁻⁴), a brief screening tool for behavioural and emotional problems, in preschool children. Parents of a community sample of 1,341 Spanish 3-year-olds and teachers of a sample of 622 children responded to the SDQ³⁻⁴ and different measures of psychopathology. Confirmatory Factor Analysis yielded adequate fit of the model to the original structure. Internal consistency (omega coefficient) for total scores was .87 for parents and .91 for teachers. Convergent validity of SDQ³⁻⁴-parents' reports with Achenbach's taxonomy and diagnostic interview was good, but low for SDQ³⁻⁴-teachers' reports. The SDQ³⁻⁴ showed predictive accuracy for discriminating use of mental health services and functional impairment. This is the first work presenting empirical evidence of the reliability and validity of the parents' and teachers' SDQ³⁻⁴ for preschoolers. The SDQ³⁻⁴ presents acceptable psychometric properties for use in the identification of preschool children who might have behavioural or emotional problems.

Key words: preschool children; psychometric properties; reliability; screening; Strengths and Difficulties Questionnaire; validity.

Psychometric properties of the Strengths and Difficulties Questionnaire³⁻⁴ in 3-year-old Spanish preschoolers

The Strengths and Difficulties Questionnaire (SDQ) is a brief screening tool for parents, teachers, and children designed to help identify children aged 3 to 16 who might have behavioural or emotional problems [1]. It is available in different languages (www.sdqinfo.org), and has become one of the most widely used questionnaires on psychopathology in clinical, educational and research settings. Its extensive use throughout the world provides extraordinary potential for the cross-cultural study of child and adolescent mental health [2]. However, it is necessary to verify whether the questionnaire is psychometrically sound across different cultures, for different informants and for children of different ages.

The questionnaire, which is quick and easy to answer, is made up of 25 items on five scales: 1) emotional symptoms, reflecting problems with somatisation, worries, unhappiness, nervousness or fears; 2) conduct problems, reflecting temper tantrums, disobedience, fights, argumentativeness or spitefulness; 3) hyperactivity/inattention, covering restless, fidgeting, distractions, impulsiveness or poor attention span; 4) peer relationship problems, such as being solitary, having few friends, peer dislike, bullying or uneasy relationships; and 5) prosocial behaviour, including empathic, sharing, helpful, and kindness behaviours. The items of the first four scales provide a total Difficulties score. The questionnaire also has an impact supplement, useful for considering possible service use, in which the informant judges whether the child has a problem and the degree of distress, social impairment, and burden to others it causes. There are different versions for parents and teachers and a youth self-report (for 11 to 16-year-olds); all contain the same items, with a slight change of wording in the youth self-report. There is a specific version for assessing 3 to 4-year-old children which differs slightly from the other versions.

The psychometric qualities of the questionnaire have been extensively studied, and it shows robust properties [3]. A review of 48 studies using the parent and teacher versions for 4 to 12-year-olds revealed satisfactory internal consistency, sufficient reliability over time, relatively high parent-teacher agreement, high correlations with other measures of psychopathology, acceptable screening ability for differentiating children with psychological problems from those without, and evidence of predictive validity with regard to seeking help [4]. The 5-factor structure has been confirmed for parents, teachers, and youngsters in some studies [5, 6] but not in others, which showed different structures [7, 8]. Two broader internalising factors (sum of the items of emotional and peers subscales) and externalising factors (sum of items of conduct and hyperactivity subscales) have been proposed in 5 to 16-year-old children [9]. These alternative broad factors might be useful for identifying psychological problems in low-risk populations, whereas the 5-factor structure would be more recommendable for high-risk children, such as those with mental disorders [9].

The SDQ has been adopted in mental health contexts as part of the initial assessment or to evaluate outcomes for specific interventions [10], and as a screening tool in community samples [11]. On the whole, the literature indicates that the SDQ provides a useful measure for improving the detection of children with psychiatric disorders [12], with excellent specificity and moderate sensitivity. However, there are few studies on the SDQ for the youngest preschool children. A German study reported the validity of the teacher version for 282 three to five-year-old preschoolers using the version for those aged 4 to 16 [13]. SDQ scores correlated with other German measures of positive and negative aspects of behaviour, and the scales discriminated a developmentally-delayed group from a comparison group. No other indications of the psychometric properties of the version for 3 to 4-year-old children were found in the literature review.

The objective of this work is to evaluate the psychometric properties of the SDQ in preschool children at age 3, in an extensive Spanish community sample, as long as it is

important to provide empirical evidence in which the test is to be used [14]. This is the first study that assesses whether the SDQ³⁻⁴ shows appropriate psychometric properties for preschoolers, considering parents' and teachers' reports. Thus, the specific objectives are: (a) to confirm the two internal structures proposed by Goodman (2010) that can be used in different populations of high-risk or low-risk children, as explained earlier, and to evaluate measurement invariance across informants (parents and teachers) and sex of children that permits the comparison of SDQ³⁻⁴ results on studying different groups of responses; (b) to analyse the internal consistency reliability of the derived SDQ³⁻⁴ scales, and (c) to provide validity evidence in relation to external variables such as other measures of psychopathology (dimensional and diagnostic) and other relevant variables in mental health, including use of services or functional impairment, with a view to identifying those situations in which the SDQ³⁻⁴ could be most useful as a screening tool.

Method

Participants

Data correspond to the first assessment of a large-scale longitudinal study of behavioural problems in preschool children from age 3 [15]. The measures were applied in a two-phase design, starting with a random sample of 2,283 children selected from the census of preschoolers in grade P3 (3 years old) in Barcelona for 2009-10. A total of 1,341 families agreed to participate in the first phase of the study (58.7%). Of these, 33.6% were of high socioeconomic status, 43.1% middle and 23.3% low. Children's mean age was 3.0 years (SD=0.18), 683 were boys (50.9%) and 89.3% were white. There were no sex differences ($p=.95$) between those who agreed to participate and those who declined, but semi-public schools were significantly more likely to refuse to participate than public ones ($p<.001$), and high socioeconomic status (SES) families participated more than low status families ($p<.001$). The parents of children participating in this first phase completed the SDQ³⁻⁴ parents' version,

which was used for screening purposes. Mothers answered the SDQ³⁻⁴ in 41.0% of cases, fathers in 6.8%, and the two parents filled out the same questionnaire in 52.2% of cases.

In the second phase, all children with a positive screening score for behavioural problems (n=522) and a random sample of 30% of children with a negative screening score (n=235) were invited to continue (the number of children needed in the negative screening score was calculated to guarantee statistical power for the subsequent analyses). The final second-phase sample included 622 families (10.6% of those invited declined to participate in the second phase). No statistical differences were found on comparing participants and refusals by sex ($p=.82$) or by type of school ($p=.85$). Ninety-four teachers from 54 schools answered the SDQ³⁻⁴. Children's mean age was 3.0 ($SD=0.16$), 311 were boys (50%) and 89.5% were white, while 33.0% were of high socioeconomic status, 45% middle, and 23% low.

Children showing intellectual disability or pervasive developmental disorders, and families with difficulties with Spanish or Catalan, without a primary caregiver that could report about the child, or that were moving to another city within a year were excluded (n=75, all them in the first phase of the design).

Instruments

The *Strengths and Difficulties Questionnaire* (SDQ³⁻⁴) [1] for parents and teachers of 3 to 4-year-old children was used, in its official Spanish and Catalan versions (the latter being selected and answered by 80.4% of the teachers and 85.7% of the parents). The 25-item preschool version maintains 22 items with the same content as the other versions; two items about conduct problems (lying and stealing) were substituted by oppositional behaviours (argumentativeness and spitefulness), while item 21 was reworded (Can stop and think things out before acting). The items have 3 response options (0: not true; 1: somewhat true; 2: certainly true). The SDQ³⁻⁴ used in this study also includes the impact supplement [16, 17].

Two broader internalising (sum of the items of emotional+peers subscales) and externalising factors (sum of conduct+hyperactivity subscales) [9], were also tested.

The Diagnostic Interview for Children and Adolescents for Parents of Preschool and Young Children (DICA-PPYC) [18, 19] is a semi-structured diagnostic interview designed to assess the most common psychological disorders at ages 3-7 years according to the DSM-IV-TR criteria [20]. Parents were interviewed about the presence of symptoms, and where information on symptoms was available additional questions explored service use (consultation about the symptoms or any treatment being received).

Composite diagnoses and number counts of disorders or symptoms (externalising: attention-deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD) and conduct disorder (CD); internalising: major depression, separation anxiety, generalised anxiety, specific phobia, social phobia; total: sum of internalising and externalising symptoms) were carried out. Disorders were assessed over the lifetime.

The *Child Behavior Checklist* (CBCL 1^{1/2}-5) [21] was used to measure behavioural and emotional problems dimensionally. The CBCL 1^{1/2}-5 includes a set of 100 items with 3 response options (0: not true, 1: somewhat or sometimes true, 2: very true or often true). Raw scores were used for the syndrome scales, as well as for the internalising, externalising and total problems scales.

The *Children's Global Assessment Scale* (CGAS) [22, 23] was used to rate global functional impairment associated with psychopathology (0 indicating the highest impairment and 100 the lowest). Scores above 70 indicate normal adjustment.

Procedure

The project was approved by the ethics review committee of the authors' institution. The heads of the schools participating, as well as the children's parents, received a complete description of the study. Families were recruited at the schools, gave written consent, and

received no financial reward or compensation. All parents of children from P3 (3-year-olds) in the participating schools were invited to answer the SDQ³⁻⁴. The SDQ³⁻⁴ was completed by families at home and returned to the schools. Families who agreed and met the screening criteria were contacted by telephone and interviewed at the school. Interviewers were previously trained and were blind to the children's screening group. After the interview, the interviewer completed the CGAS and parents answered the CBCL1^{1/2-5}. After obtaining permission from the parents, the teachers' questionnaires were given to them for completion before the end of the academic year.

Statistical analysis

The statistical analysis was carried out with SPSS18 and MPlus6. The data analysed are cross-sectional, and correspond to children in grade P3. Because of the multistage sample, data corresponding to the second phase were analysed through Complex Samples tools in SPSS, creating a plan file with sampling weights inversely proportional to the probability of the participant selection, and with the case weighting procedure in the MPlus6 system. In addition, all comparisons for the teachers' data were carried out using Generalised Estimating Equations (GEE procedure in SPSS system), which extends generalised linear models to accommodate dependent/correlated outcomes for clustered data (in this study, clustering was due to the same teacher answering questionnaires for children from the same homeroom). GEE included the teacher as a new random intra-factor independent variable, and models were adjusted with the normal distribution and identity link-function for numerical criteria and with the binomial distribution and logit link-function for binary outcomes.

Confirmatory Factor Analysis (CFA) was carried out with Mplus6, using Weighted Least Squares Means and Variance (WLSMV) adjusted for the categorical data method of estimation. The covariance matrix was analysed, considering parents' and teachers' reports as repeated measures. The same configuration was established for the two groups of responses,

and error covariances of analogous items were freely estimated [24]. In addition, analogous factors across groups of responses were allowed to be correlated. Goodness of fit was assessed with the common fit indices: χ^2 , CFI (comparative fit index), TLI (Tucker-Lewis Index), and RMSEA (root mean square error of approximation) [25]. Two models were tested: a) 5-first-order factors (emotion, peers, conduct, hyperactivity, and prosocial), and b) 2-second-order factors (internalising-externalising). Lastly, measurement invariance across informants and children's sex was conducted by comparing nested models with the scaled chi-square difference [26]. Internal consistency of the derived scales was measured through omega coefficient [27].

Pearson or point-biserial correlation coefficients indicated the convergent validity between SDQ³⁻⁴ scores and other psychopathological measures.

The association between the SDQ³⁻⁴ scores and use of services and impairment (CGAS score) was analysed with logistic and linear regression. Since sex constitutes a main risk factor for the use of services and the perception of children's impairment (the probability of consultation and identifying dysfunction is higher for boys than for girls) [28], sex might be expected to moderate the relationship between SDQ-scores and these outcomes; therefore, the interaction between SDQ³⁻⁴ and sex was calculated. For non-relevant interaction ($p > .10$), main effects were considered; otherwise, single effects for boys and girls were considered.

The screening accuracy of the SDQ³⁻⁴ to identify specific DSM-IV disorders was analysed through odds-ratios (OR) in logistic regressions, the area under the receiver operator curve (AUC), and sensitivity-specificity coefficients. Sensitivity and specificity was estimated for three different SDQ³⁻⁴ cut-offs: borderline threshold (scores corresponding to percentile 80), abnormal threshold (percentile 90), and a proposed cut-off for screening purposes based on sensitivity not lower than 0.70.

Results

Confirmatory Factor Analysis and Internal Consistency

Table 1 shows standardised parameters of CFA for the two final models analysed. The goodness-of-fit indices of the unconstrained baseline 5-first-order-factor model were acceptable [$\chi^2(1105)=2485.6$; CFI=0.878; TLI=0.865; RMSEA=0.031]. Partial measurement invariance across informants was satisfactory [$\Delta\chi^2(16)=23.7$; $p=0.096$], since more than 80% (21 of 25) of the factor-loading parameters were equivalent across parents' and teachers' reports [29]: all 5 for emotion, conduct and prosocial, 2 for peers, and 4 for hyperactivity (Table 1). Three of the factor loadings for nonequivalent items were higher for teachers (items 11, 14, and 21), and only one (item 23) was higher for parents, but all item loadings were above 0.39 and statistically significant ($p<0.001$). The standardised factor loading for item 14 was higher than 1 in teachers' reports, which is admissible if factors are correlated [30], as in our case. The fit statistics for this constrained final model were also acceptable: $\chi^2(1121)=2463.0$; CFI=0.882; TLI=0.871; RMSEA=0.030 (data for the complete sequence are available upon request). Internal consistency was satisfactory (ω ranging from 0.67 for prosocial in parents to 0.93 for hyperactivity in teachers).

Results for the 2-second-order-factor model were very similar (Table 1), although fit statistics for the initial baseline model were slightly lower [$\chi^2(1127)=2545.6$; CFI=0.875; TLI=0.864; RMSEA=0.031]. Results for measurement invariance were unchanged [$\Delta\chi^2(16)=23.9$; $p=0.091$], and fit statistics for the final model were also acceptable: $\chi^2(1143)=2523.0$; CFI=0.878; TLI=0.870; RMSEA=0.030. All item loadings were also above 0.39 and statistically significant ($p<0.01$). Internal consistency for the two second-order factors was also satisfactory (ω between 0.81 for internalising in parents and 0.91 for externalising in teachers).

Internal consistency of total scores was .87 for parents and .91 for teachers.

INSERT TABLE 1

Additionally, multi-group models by sex within each informant yielded similar results: for parents' reports full measurement invariance (all 25 factor loadings) [$\Delta\chi^2(20)=19.4$; $p=0.499$] across sex was achieved, and for teachers' reports partial measurement invariance (22 of 25 factor loadings) [$\Delta\chi^2(17)=25.8$; $p=0.078$] across sex was obtained. For the latter, non-equivalent factor loadings across girls and boys were all still above 0.40 (data not shown).

Convergent Validity of SDQ³⁻⁴ with other measures of psychopathology

Parents' SDQ³⁻⁴ scores were moderately associated with the theoretically most closely related CBCL1^{1/2-5} and dimensional DICA-PPYC measures, with absolute correlation coefficients higher than .30 (Table 2). Regarding specific DSM-IV disorders, the SDQ³⁻⁴ behaviour, hyperactivity, externalising and total scales correlated with DICA-PPYC behavioural disruptive disorders; the SDQ³⁻⁴ hyperactivity, externalising and total scores correlated with DICA-PPYC attention-deficit hyperactivity disorder; and SDQ³⁻⁴ internalising was associated with DICA-PPYC anxiety disorders.

For teachers, only four associations were practically relevant, achieving correlations above .30: a) the SDQ-hyperactivity score correlated positively with CBCL-attention score ($r=.36$) and with the number of DSM-IV externalising symptoms on DICA-PPY ($r=.31$); and b) the SDQ-externalising factor was associated with CBCL-attention ($r=.34$) and the number of DSM-IV externalising symptoms ($r=.35$) (See Annex Table 2).

INSERT TABLE 2**Association of SDQ³⁻⁴ with use of services and functional impairment**

In total, 18.1% (21.7 for boys and 14.3 for girls, $p=.017$) of the families reported use of services due to the child's psychological problems, while 11.9% (13.8 for boys and 10.1

for girls, $p=.153$) reported impairment (CGAS score below cut-off of 70) associated with the child's symptoms.

As shown in Table 3, no interaction between sex and SDQ³⁻⁴ was found for parents' reports, indicating that the associations between the SDQ³⁻⁴ scores and use of services (yes/no) and functional impairment (CGAS total score) were equal for boys and girls. The odds ratios that estimated main effects show that SDQ³⁻⁴ and the use of services are positively related (the higher the SDQ³⁻⁴ score, the higher the risk of consultation). Similarly, the negative B-coefficients in linear regressions for impairment (raw CGAS score) as outcome indicated that higher SDQ³⁻⁴ scores were associated with lower CGAS scores (meaning greater impairment).

INSERT TABLE 3

Results for teachers' reports also indicated that high SDQ³⁻⁴ scores were associated with use of services and functional impairment. Some relevant interactions emerged, and sex moderated the relationships between use of services and SDQ-internalising ($p=.009$), SDQ-total score ($p=.086$) and SDQ-impact score ($p=.027$): boys with high scores had high odds of using services. Sex also moderated the association between the SDQ-internalising scale and impairment ($p=.060$): the odds of impairment increased in girls with high scores.

Screening accuracy of SDQ³⁻⁴ to identify DSM-IV disorders and impairment

All SDQ³⁻⁴ scale scores, for both parents' and teachers' reports, discriminated between presence and absence of the corresponding DSM-IV disorder (Table 4). The discriminative accuracy size was between good and very good for parents, AUC ranging from .62 (impact) to .87 (hyperactivity), but lower for teachers, with AUC from .57 (impact) to .82 (prosocial). The predictive accuracy of impact score on the presence of impairment (CGAS<70) was also good for parents' reports (AUC=.65) and low for teachers' data (AUC=.58).

Sensitivity was low for all SDQ³⁻⁴ scales and cut-off-points (borderline and abnormal), for both parents' and teachers' reports, with the exception of SDQ-teacher-prosocial scale and borderline cut-off (Se=92.8). Specificity was good to very good considering abnormal and borderline cut-off-points (values from .68 to 97.1). For screening purposes, Annex 1 (online material) shows the sensitivity and specificity for all cut-offs under the borderline threshold for all the scales. The last column of Table 4 shows proposed cut-offs for screening, which guarantee sensitivity values above 0.70.

INSERT TABLE 4

Description of scores by sex

Annex 2 (online material) shows the means and standard deviations of raw scores for the scales. Although some statistical differences emerged by sex, these results must be considered with caution due the large sample sizes. Effect sizes comparing mean scores by sex through Cohen's *d* did not produce relevant coefficients ($d < .50$).

Annex 3 (online material) shows the cut-off-point for children with scores over percentile 80 (borderline) and percentile 90 (abnormal).

Discussion

This is the first study to analyse the psychometric properties of parents' and teachers' SDQ³⁻⁴. Results show acceptable internal consistency, moderate convergent validity with other measures of psychopathology and with other mental health outcomes such as service use or functional impairment, and good to very good ability to discriminate between those children with a DSM-IV disorder and those without, as well as confirming the proposed internal structures. The availability of such a psychometrically adequate screening tool is useful for identifying 3-year-old preschool children from the general population at high risk of behavioural or emotional problems who would benefit from thorough assessment and

adequate intervention programmes during their preschool years. The focus on preschool difficulties can help to avoid chronic conditions throughout childhood, comorbidity and personal and family dysfunction.

A 5-first-order factor structure and a 2-second-order internalising-externalising structure were confirmed for both versions of the questionnaire. Both solutions could be appropriate in different research and clinical situations. The individual scales could be useful on screening for specific disorders, and specifically, the conduct, hyperactive and prosocial scales perform well in identifying 3-year-olds with oppositional defiant disorder, conduct disorder or ADHD. In other situations, such as epidemiological studies or other studies in populations with low rates of disorder, the broader factors could prove useful. The internalising and externalising factors converged with the corresponding CBCL 1½-5 factors, seeming to be useful for identifying children with functional impairment and those using services because of psychological symptoms. Also, the externalising factor derived from the parents' questionnaire showed a good level of predictive accuracy for identifying children with disruptive behaviour disorders.

Parents' scales were internally consistent, the least consistent being the prosocial scale. Parents have fewer opportunities than teachers for observing the behaviours described in this scale, and their answers may have given rise to less internal consistency. The parents' answers to the SDQ are moderately associated with the information they themselves provide in the CBCL scales, both for the scales assessing emotional symptoms and for those assessing conduct problems symptoms, and this represents evidence of convergence. Few scales showed significant associations with DSM-IV diagnosis, but considering the few items making up each scale, the associations obtained are noteworthy (conduct, hyperactivity, total and externalising with disruptive behaviour disorders and anxiety disorders with internalising). With the exception of impact, all the scales showed good predictive validity to identify cases with and without a diagnosis, the best-performing scales being those related to

behaviour problems (conduct, hyperactive and externalising). General scales are also useful for identifying children with a functioning considered clinically impaired and that need professional services because of mental health problems.

For the teachers' version, internal consistency was high. Most of the teachers' scales did not correlate with the CBCL 1^{1/2}-5 scales answered by parents, but they did correlate with dimensional measures derived from the diagnostic interview that covered similar concepts. The weak relationships between teacher (SDQ³⁻⁴) and parent (CBCL 1^{1/2}-5) reports has been widely found using different questionnaires and at different ages, and must be explained by the fact that different informants observe different behaviours in different contexts [31, 32]. The association of the teachers' SDQ³⁻⁴ scores and use of services and impairment was dependent, in some cases, on the child's sex: boys' problems as perceived by the teachers were more associated with use of services than girls' problems. A possible explanation is that teachers perceive boys problems as more severe and requiring professional help. On the other hand, teachers perceive girls with high internalising scores as more impaired than boys; even so, the association between internalising scores and use of services was significant for boys and not for girls. Interestingly, Kavanagh and Hops [33] showed that there were substantial biases when parents and teachers rated different behaviours in boys and girls, which is a difficulty for the proper identification and treatment of cases, resulting in greater use of services for boys than for girls [34]. The identification of this bias from such an early age is very important, and means that girls are candidates to receive fewer services than boys [34] from very early in life. The questionnaire also shows moderate to very good ability to identify cases and non-cases. Scale scores derived from the teachers' questionnaire were associated with DSM-IV diagnosis, but teacher's SDQ³⁻⁴ was good for discriminating only between cases and non-cases of ADHD and conduct disorder. This is especially notable given that the criteria (diagnosis derived from parents' interview) and the questionnaire informant (teacher) were different, and suggests that by using the SDQ³⁻⁴ in the school setting teachers can help to

identify children with ADHD and conduct disorder quite accurately. It is important to point out that, contrary to reports in older children [9], the prosocial scale discriminated very well ($AUC = .82$) children with conduct disorder. For the borderline cut-off the high sensitivity is also noteworthy. The usefulness of this scale is especially relevant given the severe consequences of early-onset conduct disorder [35].

Regarding cut-off scores, in a sample like the one studied, with low prevalence of disorders, the specificity is not of great interest. However, sensitivity indicates the probability of a child with a DSM-IV disorder being detected from the cut-offs of the SDQ³⁻⁴. Using borderline cut-offs, the sensitivity is only acceptable for the parents' scale hyperactivity and for the teacher's scale prosocial; the remaining cut-offs (for borderline and abnormal) would leave unidentified a high percentage of DSM-IV diagnoses. If the SDQ³⁻⁴ is to be used as a screening tool, the proposed screening cut-offs, which guarantee a sensitivity above 70%, should be employed. For 3-year-olds, the impact score does not seem to be a good indicator for discriminating children with any DSM-IV disorder or with functional impairment as assessed with other instruments.

Although we cannot compare our results against previous data, we can state that both the parent and teacher versions show acceptable psychometric properties for their use with 3-year-olds. Evaluating the preschool population is a difficult task, given that research in this field is still at an early stage in its development [36], and access to psychometrically sound instruments can aid progress in this direction. As reported elsewhere [4], the reliability of the teachers' version was greater than that of the parents' version. Convergent validity is better for the parents' than the teachers' questionnaire, but this could be an effect of it being the same rater who responds both psychopathology measures in the parents' case. Association with other measures such as functional impairment or use of services was equally strong for the two questionnaires.

Some limitations should be taken into account on interpreting the present results. For the validation of the teacher questionnaire we only had the information about psychopathology provided by the teacher in the SDQ³⁻⁴, and comparisons with other measures will be affected by informant bias. Furthermore, since we studied a sample of the general population, and psychopathology is not very frequent in community samples, the discriminative power may have been affected. Also, few families of low socioeconomic status participated, and this could have led to bias. Finally, the psychometric properties reported are generalisable to preschool children from the general population.

Taken together, the results suggest that SDQ³⁻⁴ is a promising questionnaire for early identification of psychological problems in the preschool years. The different factors identified, with good reliability and validity, may be of use in a range of clinical and research contexts.

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Table 1. Confirmatory factor analysis (standardized factor loadings and factor correlations) and internal consistency (omega) of SDQ³⁻⁴

	First-order model		Second-order model		
	Parents (N = 1,341)	Teachers (N = 622)	Parents (N = 1,341)	Teachers (N = 622)	
First-order factor loadings					
Emotion	.78	.84			
3. Complains of headaches	.413	.461	.406	.453	
8. Worries	.677	.756	.682	.761	
13. Unhappy	.859	.959	.863	.962	
16. Nervous-clingy	.653	.729	.650	.725	
24. Fears-scared	.577	.644	.575	.641	
Peers	.70	.75			
6. Solitary	.635	.558	.633	.550	
11. Has one good friend *	-.547	-.658	-.535	-.659	
14. Liked by other children *	-.625	-1.021	-.616	-1.023	
19. Picked on-bullied by others	.436	.383	.449	.390	
23. Gets on better with adults	.614	.446	.627	.445	
Conduct	.72	.85			
5. Temper tantrums	.626	.754	.622	.749	
7. Obedient *	-.675	-.813	-.679	-.817	
12. Fights-bullies other children	.670	.807	.674	.811	
18. Argumentative with adults	.608	.731	.608	.731	
22. Spiteful to others	.396	.476	.390	.469	
Hyperactivity	.82	.93			
2. Restless	.787	.923	.786	.922	
10. Fidgeting-squirming	.738	.866	.738	.865	
15. Distracted	.744	.873	.743	.872	
21. Thinks before acting *	-.505	-.817	-.509	-.822	
25. Good attention span *	-.693	-.813	-.693	-.813	
Prosocial (Pr)	.67	.86	.68	.87	
1. Considerate of other's feelings *	.639	.872	.641	.875	
4. Shares *	.566	.772	.565	.771	
9. Helpful *	.543	.741	.541	.738	
17. Kind to younger children *	.502	.685	.500	.683	
20. Volunteers to help *	.495	.675	.498	.679	
Second-order factor loadings					
Internalizing (Int)			.81	.86	
Emotion			.747	.545	
Peers			.866	1.024	
Externalizing (Ext)			.83	.91	
Conduct			.900	.838	
Hyperactivity			.663	.716	
Factor correlations within each group					
Emotion-Peers	.646	.559	Int-Ext	.632	.571
Emotion-Conduct	.472	.329	Pr-Int	-.448	-.588
Emotion-Hyperactivity	.395	.273	Pr-Ext	-.541	-.775
Emotion-Prosocial	-.218	-.240			
Peers-Conduct	.436	.435			
Peers-Hyperactivity	.287	.406			
Peers-Prosocial	-.498	-.634			
Conduct-Hyperactivity	.596	.600			
Conduct-Prosocial	-.539	-.698			
Hyperactivity-Prosocial	-.308	-.513			

Note: Error variances and covariances between groups of responses are omitted. Items with * are inverse. All parameters, $p < .05$. In bold: factor loadings non-equivalent across informants; in italics: internal consistency (omega coefficient)

Table 2. Convergence between SDQ³⁻⁴-parents and CBCL and DICA-PPY.

	SDQ-scale (parents)							
	Emotional	Conduct	Hyperactivity	Peers	Prosocial	Internalising	Externalising	Total
CBCL 1 ^{1/2} -5								
Emotionally-reactive	.42	.23	.21	.27	.18	.43	.26	.41
Anxious-depressed	.49	.22	.20	.28	.11	.48	.25	.43
Somatic-complaints	.26	.10	.03	.19	-.04	.28	.07	.19
Withdrawn	.28	.20	.22	.39	.25	.42	.25	.40
Sleep-problems	.25	.07	.09	.13	.09	.24	.10	.20
Attention-problems	.19	.27	.66	.18	.12	.23	.59	.55
Aggressive-behaviour	.21	.53	.39	.17	.32	.24	.54	.52
Internalising	.48	.25	.22	.36	.17	.52	.28	.47
Externalising	.23	.52	.51	.19	.30	.27	.62	.59
Total	.42	.39	.40	.31	.25	.46	.47	.58
DICA-PPY								
Any DSM-IV disorder	.21	.16	.17	.19	.13	.24	.20	.27
Disruptive behaviour dis.	.16	.34	.31	.12	.18	.17	.39	.37
ADHD	.13	.23	.33	.10	.08	.15	.35	.33
ODD	.15	.27	.15	.09	.17	.15	.24	.25
CD	.12	.11	.16	.11	.10	.14	.16	.19
Mood disorders	.03	.06	.05	.15	-.03	.11	.07	.11
Anxiety disorders	.25	.07	.09	.25	.13	.30	.10	.23
Separation anxiety	.18	.10	.08	.27	.11	.28	.11	.23
Generalised anxiety	.08	.10	.06	.03	.02	.07	.09	.10
Specific phobia	.15	.02	.10	.11	.08	.16	.08	.14
Social phobia	.19	.01	.05	.21	.07	.24	.03	.15
# DSM-IV disorders	.30	.23	.26	.27	.16	.35	.30	.40
# internalising sympt	.36	.11	.08	.31	.13	.41	.11	.29
# externalising sympt	.18	.41	.51	.18	.21	.22	.56	.52
# total symptoms	.30	.37	.44	.29	.23	.36	.49	.54

Data for phase 2 sample (N=622). In bold, high coefficients ($|R| \geq .30$). ADHD: attention-deficit hyperactivity disorder; ODD: oppositional defiant disorder; CD: conduct disorder.

Teacher correlations available online

Table 3. Association between SDQ³⁻⁴ and the use of services and functional impairment.

Criteria	Informant	SDQ ³⁻⁴ scale	<i>p</i>	OR (95% CI)
Use of services	Parents	Internalising	<.001	1.20 (1.12; 1.29)
		Externalising	.007	1.08 (1.02; 1.14)
		Total	<.001	1.12 (1.08; 1.17)
		Impact	<.001	1.67 (1.39; 2.02)
	Teachers	Internalising	.424 ^G	.96 (0.87; 1.06)
			.002 ^B	1.14 (1.05; 1.24)
		Externalising	.006	1.06 (1.02; 1.11)
		Total	.197 ^G	1.03 (0.99; 1.08)
		Impact	.001 ^B	1.09 (1.04; 1.13)
			.119 ^G	1.23 (0.95; 1.59)
			<.001 ^B	1.80 (1.45; 2.25)
	Informant	SDQ ³⁻⁴ scale	<i>p</i>	<i>B</i> (95% CI)
Impairment	Parents	Internalising	<.001	-0.84 (-1.09; -.59)
		Externalising	<.001	-0.88 (-1.06; -.69)
		Total	<.001	-0.86 (-0.99; -.74)
		Impact	<.001	-3.20 (-3.88; -2.51)
	Teachers	Internalising	.029 ^G	-0.33 (-0.62; -0.03)
			.719 ^B	-0.05 (-0.23; 0.33)
		Externalising	.001	-0.38 (-0.53; -0.22)
		Total	<.001	-0.30 (-0.40; -0.19)
		Impact	<.001	-1.91 (-2.58; -1.24)

(*N* = 622). ^BSingle effect for boys. ^GSingle effect for girls.

Table 4. Screening predictive accuracy of SDQ³⁻⁴ for DSM-IV disorders and impairment.

	SDQ scale	DSM-IV disorder	¹ Prev	Total SDQ	Borderline cut-off (SDQ-P ₈₀)			Abnormal cut-off (SDQ-P ₉₀)			Screening cut-off (Proposed)			AUC (95% CI)
				OR	Score	Se	Sp	Score	Se	Sp	Score	Se	Sp	
Parents' reports	Emotion	Mood-anxiety	7.98	1.58*	3	49.4	82.0	4	32.2	91.2	2	77.8	61.5	.71 (.64; .78)
	Peers	Mood-anxiety	7.98	1.45*	3	41.5	83.9	4	29.3	92.6	1	70.9	40.6	.66 (.58; .74)
	Conduct	ODD-CD	7.61	1.80*	4	63.1	75.9	5	46.3	87.5	3	89.8	51.8	.75 (.69; .81)
	Hyperactive	ADHD	3.71	1.84*	6	76.5	76.6	7	63.3	84.4	6	76.5	76.6	.87 (.81; .93)
	Prosocial	CD	1.36	1.43*	4	28.8	80.8	5	28.8	90.7	2	100.0	42.3	.73 (.61; .86)
	Total score	Any disorder	15.5	1.22*	13	52.1	83.4	17	29.9	95.8	10	74.2	62.1	.74 (.69; .79)
	Internalising	Mood-anxiety	7.98	1.36*	5	48.2	82.4	7	30.9	93.4	3	70.5	55.7	.73 (.66; .80)
	Externalising	ADHD-ODD-CD	10.1	1.44*	9	65.6	76.7	11	49.2	90.8	8	75.1	68.5	.79 (.74; .84)
	Impact	Any disorder	15.5	2.01*	1	28.5	93.7	2	16.2	97.1	1	28.5	93.7	.62 (.56; .68)
	Impact	² Impairment	11.9	2.18*	1	34.3	93.6	2	22.5	97.4	1	34.3	93.6	.65 (.59; .72)
Teachers' reports	Emotion	Mood-anxiety	7.98	1.16*	3	35.0	80.6	4	15.0	88.6	1	78.7	48.7	.60 (.53; .68)
	Peers	Mood-anxiety	7.98	1.30*	3	43.7	79.4	4	31.3	88.2	1	71.3	41.1	.62 (.54; .70)
	Conduct	ODD-CD	7.61	1.22*	4	32.1	79.8	5	23.1	87.7	1	79.5	35.9	.62 (.55; .69)
	Hyperactive	ADHD	3.71	1.44*	6	55.4	79.8	8	34.3	90.6	5	71.1	70.6	.81 (.74; .87)
	Prosocial	CD	1.36	1.66*	5	92.8	68.0	6	57.2	85.0	5	92.8	68.0	.82 (.73; .92)
	Total score	Any disorder	15.5	1.07*	12	38.2	78.3	16	18.5	89.2	6	72.1	44.3	.62 (.57; .68)
	Internalising	Mood-anxiety	7.98	1.15*	5	40.0	78.3	7	25.0	89.1	2	81.2	44.0	.64 (.56; .71)
	Externalising	ADHD-ODD-CD	10.1	1.15*	9	38.5	80.4	11	20.3	90.7	5	70.3	54.3	.68 (.62; .74)
	Impact	Any disorder	15.5	1.34*	1	29.9	84.7	2	20.8	90.6	1	29.9	84.7	.57 (.51; .63)
	Impact	² Impairment	11.9	1.38*	1	31.9	84.2	2	23.3	90.4	1	31.9	84.2	.58 (.51; .65)

(N = 622).

¹Weighted prevalence for the DSM-IV disorder (in percentage, %).²Impairment was considered for CGAS scores under 70.

ODD: oppositional defiant disorder. CD: conduct disorder. ADHD: attention-deficit hyperactivity disorder.

Any disorder: mood, anxiety, ODD, CD, and ADHD.

AUC: area under ROC curve. Se: sensitivity. Sp: Specificity.

SDQ-P₈₀: percentile 80 for SDQ factor score. SDQ-P₉₀: percentile 90 for SDQ factor score.

OR values and AUC obtained through logistic regression. *Significant OR coefficient.

Annex 1: Means and standard deviations for direct-scores.

[illegible][illegible]

Psychometric properties of the SDQ 28

[illegible]

Annex 2: Means and standard deviations for direct-scores.

PARENTS' REPORTS		Total (N=1341)	Girls (N=658)	Boys (N=683)	Sex differences	
Scale		Mean (SD)	Mean (SD)	Mean (SD)	p	d
Emotional symptoms		1.55 (1.61)	1.57 (1.64)	1.52 (1.57)	.54	.031
Conduct problems		2.61 (1.85)	2.55 (1.81)	2.68 (1.88)	.20	.070
Hyperactivity		3.83 (2.48)	3.51 (2.39)	4.15 (2.53)	<.001	.260
Peer problems		1.39 (1.61)	1.34 (1.49)	1.44 (1.73)	.22	.062
Prosocial		2.16 (1.67)	1.92 (1.60)	2.39 (1.70)	<.001	.285
Total difficulties (emot.+cond.+hyp.+peer)		9.38 (5.25)	8.94 (5.06)	9.79 (5.41)	.003	.162
Impact-distress		0.24 (0.94)	0.18 (0.76)	0.30 (1.08)	.018	.129
Internalizing (emotional+peer)		2.94 (2.66)	2.90 (2.58)	2.97 (2.73)	.67	.026
Externalizing (conduct+hyper.)		6.45 (3.67)	6.05 (3.58)	6.83 (3.71)	<.001	.214
TEACHERS' REPORTS		Total (N=622)	Girls (N=311)	Boys (N=311)	Sex differences	
Scale		Mean (SD)	Mean (SD)	Mean (SD)	p	d
Emotional symptoms		1.33 (1.73)	1.31 (1.77)	1.35 (1.70)	.72	.023
Conduct problems		1.87 (2.04)	1.72 (1.95)	2.02 (2.12)	.023	.147
Hyperactivity		3.16 (2.82)	2.58 (2.60)	3.72 (2.92)	<.001	.412
Peer problems		1.46 (1.68)	1.37 (1.61)	1.56 (1.73)	.081	.114
Prosocial		3.22 (2.27)	2.67 (2.19)	3.76 (2.22)	<.001	.494
Total difficulties (emot.+cond.+hyp.+peer)		7.82 (5.65)	6.98 (5.47)	8.64 (5.71)	<.001	.297
Impact-distress		0.37 (0.93)	0.29 (0.87)	0.45 (0.99)	.011	.172
Internalizing (emotional+peer)		2.79 (2.84)	2.68 (2.91)	2.90 (2.77)	.21	.077
Externalizing (conduct+hyper.)		5.03 (4.12)	4.30 (3.92)	5.74 (4.20)	<.001	.354

d: Cohen's d measuring effect size.

Annex 3: Groups of normal-borderline-abnormal based on direct-scores.

PARENTS' REPORTS	Total (N=1341)			Girls (N=658)			Boys (N=683)		
Scale	Normal	Borderline	Abnormal	Normal	Borderline	Abnormal	Normal	Borderline	Abnormal
Emotional symptoms	0-2	3	4-10	0-2	3	4-10	0-1	2-3	4-10
Conduct problems	0-3	4	5-10	0-3	4	5-10	0-3	4	5-10
Hyperactivity	0-5	6	7- 10	0-4	5-6	7- 10	0-5	6-7	8- 10
Peer problems	0-2	3	4-10	0-1	2	3-10	0-2	3	4-10
Prosocial	0-3	4	5-10	0-2	3	4-10	0-3	4	5-10
Total difficulties (emot.+conduct+hyper.+peer)	0-12	13-16	17-40	0-11	12-14	15-40	0-13	14-16	17-40
Impact-distress	0	1	2-10	0	1	2-10	0	1	2-10
Internalizing (emotional+peer)	0-4	5-6	7-20	0-4	5-6	7-20	0-4	5-6	7-20
Externalizing (conduct+hyper.)	0-8	9-10	11-20	0-8	9-10	11-20	0-9	10-11	12-20
TEACHERS' REPORTS	Total (N=622)			Girls (N=311)			Boys (N=311)		
Scale	Normal	Borderline	Abnormal	Normal	Borderline	Abnormal	Normal	Borderline	Abnormal
Emotional symptoms	0-2	3	4-10	0-1	2-3	4-10	0-2	3	4-10
Conduct problems	0-3	4	5-10	0-2	3-4	5-10	0-3	4	5-10
Hyperactivity	0-5	6-7	8-10	0-4	5	6-10	0-5	6-7	8-10
Peer problems	0-2	3	4-10	0-1	2	3-10	0-2	3	4-10
Prosocial	0-4	5	6-10	0-4	5	6-10	0-5	6	7-10
Total difficulties (emot.+conduct+hyper.+peer)	0-11	12-15	16-40	0-10	11-15	16-40	0-12	13-15	16-40
Impact-distress	0	1	2-10	0	1	2-10	0	1	2-10
Internalizing (emotional+peer)	0-4	5-6	7-20	0-4	5-6	7-20	0-4	5-6	7-20
Externalizing (conduct+hyper.)	0-8	9-10	11-20	0-6	7-9	10-20	0-9	10	11-20

Borderline=Percentile 80; Abnormal=Percentile 90.