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BRIEF REPORT

A critical examination of Danish norms for the Strengths and Difficulties Questionnaire (SDQ)

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ABSTRACT

Objective: The objective was to describe observed differences between the official Danish Strengths and Difficulties Questionnaire (SDQ)-norms and data from a sample based on the Danish National Birth Cohort (DNBC) including children born between 1996 and 2003. We compared the risk classification, cut-off bandings and the group sizes between the Danish norms and the values found in our sample at ages 7, 11 and 18 years.

Results: Two sets of norms are used in Denmark: Arnfred's norms, based on a sample from one single Danish municipality and Niclasen's norms, based on multiple Danish cohorts, including the DNBC. Inconsistencies were found between banding scores in the two existing norms and the banding scores identified in our sample from DNBC: discrepancies included banding scores for several of the problem scales for children and preadolescents. For adolescents, we found less apparent inconsistencies between Arnfred's sample and the DNBC. Results demonstrate that the existing SDQ norms do not apply well to a large-scale cohort sample in Denmark. The usefulness of the SDQ as a screening instrument for mental health problems depends on appropriate norms. We therefore urge that the current Danish SDQ norms are used with caution, and preferably they should be revised.

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Strengths and difficulties questionnaire; psychometric properties; adolescent; danish norms

Introduction

Childhood mental health problems are often persistent and adult mental disorders begin before age 18 in almost half of affected individuals [1]. The potential for early intervention to prevent persistent mental disorders has become increasingly apparent. A prerequisite for appropriate intervention is identification of children at high risk of psychopathology. Mental health problems are not always detected as a part of routine care in primary care settings [2, 3] so key professionals such as general practitioners, community health nurses and educational psychologists often use screening instruments for the detection of psychopathology among children as part of the assessment and referral processes. The use of validated screening instruments may be useful in assisting identification of psychopathology among children and adolescents. Screening instruments must display an acceptable level of accuracy and the strengths and limitations of the instrument must be fully understood [4]. Similarly they should include firm and relevant thresholds/norm values for detecting children likely to have problems, triggering a more detailed assessment when appropriate. The use of screening instruments is only desirable if the instrument and its thresholds are reliable.

The Strengths and Difficulties Questionnaire (SDQ) has repeatedly proven to be a useful and validated instrument to identify children at elevated risk of mental health problems [5, 6]. It is widely used and is translated into more than 70 languages. SDQ is used as a screening instrument in numerous settings outside psychiatric services such as in municipalities, schools etc. The reliability and validity of the Danish SDQ have also been endorsed [7, 8], and two sets of norms for Danish children and adolescents have been established and published [7, 9]. One set contains norms for both young children, preadolescents and adolescents [9], whereas the other only covers children up to 12 years of age [7].

We analysed SDQ scores from children aged 7, preadolescents aged 11 and adolescents aged 18 years in the large-scale Danish National Birth cohort [10] and compared the proportions of high-risk children identified using the official norms with norms derived within our sample.

Methods

We assessed how the risk classification ('normal-borderline-abnormal' as opposed to 'close to average-slightly raised-high-very high'), the resulting cut-off bandings and the group sizes

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differed between the available Danish norms and the values found in our sample for the age groups: 7, 11 and 18 years. Our sample included children from the Danish National Birth Cohort (DNBC) [10]. The DNBC is a longitudinal nationwide cohort that was established to examine the relationship between early determinants and later health-related outcomes. The cohort included about 100,000 mother-infant dyads enrolled through general practice between 1996–2003. For more information, please visit www.dnbc.dk.

We included children if they were full-term singleton births (n = 88,932). We excluded children with major congenital anomalies (n = 1,422), children diagnosed with conditions affecting the central nervous system (n = 251) and global developmental delay (n = 17) because these relatively rare conditions are likely to cause mental health changes, with markedly differential impact on samples recruited through different sampling strategies. The age seven follow-up included 51,383 children, the age 11 year follow-up included 42,895 preadolescents and the age 18 year follow-up included 41,941 adolescents. We defined two categories in the five subscales and the total difficulties scale: a high-scoring group against an average group. The high-scoring group threshold identified the 10% with the highest problem score in each follow-up.

The Strengths and Difficulties Questionnaire (SDQ)

The SDQ assesses five areas of social-behavioural development in children and adolescents: emotional symptoms, hyperactivity/inattention, conduct problems, peer relationship problems and pro-social behaviour. It can be completed by parents, caregivers, teachers and from the age of 11 by the young people themselves [5]. The SDQ comprises 25 questions in five domains which are rated on a 3-point Likert scale [5]. For the four 'problem' scales (emotional, hyperactivity/inattention, conduct and peer relationship problems) as well as the total difficulties scale (which sums these four scores), higher scores indicate more mental health problems whereas the prosocial behaviour scale uses reverse scoring.

Danish norms for the SDQ

The Danish norms are available on the main SDQ website www.sdq.dk, and published by Arnfred et al. 2019 (henceforth Arnfred's norms) [9]. These norms are based on a survey conducted in the Municipality of Assens in central Denmark. The children were recruited from municipal day-care services, kindergartens or schools. The sample comprised 1,955 children and 1,609 adolescents, and included children in special educational settings, but not children in private day-care/kindergarten or school. Arnfred's norms were defined as the following four classification categories: Close to average (80% of the sample), slightly raised/lowered (10%), high/low (5%), and very high/very low (5%). Separate banding scores were specified for parent-, self- and teacher/professional administration. Arnfred's norms cover the three age groups: young children aged 2–6 years, children aged 6–10 years and preadolescents/adolescents aged 11–17 years.

Another set of Danish SDQ norm scores available on www.sdqinfo.org was published by Niclasen et al. in 2012 (henceforth Niclasen's norms) [7]. The norms are based on data from the 5 year follow-up of the Copenhagen Child Cohort 2000 (n = 5,943) [11], the 7-year follow up of the Danish National Institute of Social Research's cohort (n = 4,971) [12] and DNBC (n = 48,544) respectively [10], and the 10–12-year-old sample of the Aarhus Birth Cohort (n = 12382) [13]. Niclasen's norms are in accordance with the traditional international classification of SDQ scores into Normal (including 80% of the sample), Borderline (including 10%) and Abnormal (including 10%). Niclasen's norms cover children aged 5–7 years and preadolescents aged 10–12 years.

Results

We found several inconsistencies between banding scores in the existing norms and the banding scores identified in our sample. The extent and type of inconsistencies varied across age groups, sex and respondent types.

When we compared 5–10 year old children, we observed discrepancies in the banding scores together with proportions of included children for the peer problems scale, the total problem score for boys whereas discrepancies were observed for the emotional problems scale, peer problems scale and the prosocial scale for the girls (Table 1). The banding scores from Niclasen's study and the banding scores identified in our sample were as expected very similar for this specific age group due to the substantial sample overlap.

In general Arnfred's banding scores are broader for the 'close to average + slightly raised' (corresponding to the lowest scoring 90%) implying that this sample exhibited more symptoms of mental health problems than children from the DNBC. In the conduct scale, we found a general agreement across all three sources that a banding score below 2 includes approximately 80% of boys and 90% of girls in the samples.

For preadolescents, the banding scores likewise varied, and scores ranging between 0–4 on the emotional problem scale characterised 89.6% in our sample, while the same banding scores included 10% more of the girls in our sample than in Arnfred's sample (Table 2). Among boys, the banding scores varied for the peer problem scale and the total difficulties scale scale. For girls, scores of 0–2 on the peer problem scale included 82% of Arnfred's sample versus 89.6% of our sample. On the total difficulties scale the at-risk cut off was 11 in our sample, including 12% of girls, while 9% of girls exceeded the threshold of 15 in Arnfred's sample. The pro-social behavioural scale was the only scale where all three sources had relatively comparable findings.

Arnfred's banding scores for adolescents aged 11–17 were more consistent with our sample of 18-year-olds than observed at the younger ages (Table 3). There were small inconsistencies in the banding for the hyperactivity scale among boys, where 7% scored 8+ in Arnfred's and 9% scored 7+ in our DNBC-sample, respectively. Inconsistencies were also apparent in the emotional and conduct problem scales for girls.

Discussion

Our comparison revealed similarities and differences between existing SDQ banding scores from three different samples of Danish children, preadolescents and adolescents.

Table 1. Cut-off points for classification based on parent-reported scales of the SDQ for children aged 5–10.

	Emotional problems	Hyperactivity	Conduct problems	Peer problems	Pro-social behaviour	Total difficulties
			Boys			
Arnfred's norms[a]						
Close to average	0–4 (82.5)	0–6 (85.6)	0–2 (80.2)	0–2 (82.9)	7–10 (86.3)	0–13 (80.6)
Slightly raised/slightly lowered	5–6 (10)	7–8 (8.7)	3 (10)	3–4 (10)	6 (6.6)	14–17 (10.5)
High/low	7 (4.3)	9 (3.5)	4 (6.1)	5 (2.6)	5 (5)	18–20 (3.7)
Very high/very low	8–10 (3.1)	10 (2.2)	5–10 (3.7)	6–10 (4.2)	0–4 (2.5)	21–40 (5.3)
Niclasen's norms[b]						
Normal	0–3 (86)	0–4 (79.7)	0–2 (83.9)	0–1 (78)	7–10(83)	0–9 ((79.6)
Borderline	4 (6.4)	5–6 (12.8)	3 (9.2)	2 (11.4)	6 (9.3)	10–13 (11.7)
Abnormal	5–10 (7.6)	7–10 (7.5)	4–10 (6.9)	3–10 (10.6)	0–5(7.8)	14–40 (8.4)
DNBC[c]						
90% lowest score	0–3 (86.5)	0–5 (88.7)	0–2 (84.3)	0–2 (90)	6–10 (92.1)	0–11 (87.4)
10% highest score	4–10 (13.4)	5–10 (11.3)	3–10 (15.7)	3–10 (10)	0–5 (7.9)	12–40 (12.6)
			Girls			
Arnfred's norms[a]						
Close to average	0–4 (80.1)	0–4 (83.9)	0–2 (88.9)	0–2 (86.3)	8–10 (87.4)	0–11 (82.5)
Slightly raised/slightly lowered	5–6 (11.9)	5–6 (8.6)	3 (7.9)	3 (6.0)	7 (7.7)	12–14 (8)
High/low	7 (4.21)	7 (3.5)	–	4 (3.9)	–	15–17 (5)
Very high/very low	8–10 (3.8)	8–10 (4.1)	4–10 (3.2)	5–10 (3.8	0–6 (4.9)	18–40 (4.5)
Niclasen's norms[b]						
Normal	0–3 (85.4)	0–3 (80.6)	0–2 (86.6)	0–1 (82.2)	8–10 (81.9)	0–8 (81.1)
Borderline	4 (6.7)	4–5 (13.2)	3 (8.5)	2 (10.7)	7 (9.5)	9–11 (10.6)
Abnormal	5–10 (7.9)	6–10 (6.2)	4–10 (4.7)	3–10 (7.1)	0–6 (8.5)	12–40 (8.4)
DNBC[c]						
90% lowest problem score	0–3 (85.9)	0–4 (89.1)	0–2 (87.6)	0–2 (93.3)	7–10 (91.4)	0–10 (89.6)
10% highest problem score	4–10 (14.1)	5–10 (10.9)	3–10 (12.4)	3–10 (6.7)	0–6 (8.6)	11–40 (10.6)

Banding scores (%).
[a]6–10 year-olds. *N*= Boys: 737, girls: 713.
[b]5–7 year-olds. *N*= Boys: 28920, girls: 27611.
[c]7 year-olds. *N*= Boys: 26176, girls: 25207.

Table 2. Cut-off points for classification based on parent-reported scales of the SDQ for preadolescents aged 10–17.

	Emotional problems	Hyperactivity	Conduct problems	Peer problems	Pro-social behaviour	Total difficulties
			Boys			
Arnfred's norms[a]						
Close to average	0–3 (80.4)	0–5 (85.4)	0–2 (86.8)	0–3 (85.1)	7–10 (85.4)	0–12 (82.6)
Slightly raised/slightly lowered	4–5 (12.6)	6 (4.5)	3 (7.1)	4 (5.5)	6 (7.7)	13–16 (8.6)
High/low	6 (2.6)	7–8 (6.1)	4 (3.2)	5 (4.6)	5 (4.2)	17–19 (4)
Very high/very low	7–10 (4.4)	9–10 (4)	5–10 (2.9)	6–10 (4.9)	0–4 (2.7)	20–40 (4.9)
Niclasen's norms[b]						
Normal	0–3 (85)	0–4 (82.8)	0–2 (88)	0–2 (86.2)	7–10 (83.9)	0–10 (83.1)
Borderline	4 (6.1)	5–6 (10.4)	3 (6.7)	3 (5.3)	6 (8.3	11–13 (7.1)
Abnormal	5–10 (8.9)	7–10 (6.7)	4–10 (5.3)	4–10 (8.5)	0–5 (7.9)	14–40 (9.8)
DNBC[c]						
90% lowest score	0–4 (91.4)	0–5 (89)	0–2 (89.9)	0–3 (92.1)	6–10 (93.6)	0–12 (89.4)
10% highest score	5–10 (19.6)	6–10 (11)	3–10 (10.1)	4–10 (7.8)	0–5 (6.4)	13–40 (10.6)
			Girls			
Arnfred's norms[a]						
Close to average	0–4 (79.6)	0–3 (83.2)	0–1 (82.5)	0–2 (82.0)	8–10 (87.5)	0–10 (81.8)
Slightly raised/slightly lowered	5–6 (13.7)	4–5 (10.4)	2 (11.1)	3–4 (12.6)	7 (7.3)	11–14 (9.5)
High/low	7 (2.9)	6 (3.4)	3 (3.9)	5 (2.8)	6 (3.5)	15–17 (4.1)
Very high/very low	8–10 (3.8)	7–10 (2.9)	4–10 (2.5)	6–10 (2.7)	0–5 (1.8)	18–40 (4.6)
Niclasens' norms[b]						
Normal	0–3 (83)	0–3 (84.3)	0–1 (78.3)	0–2 (87)	8–10 (84.6)	0–8 (80.7)
Borderline	4 (7.3)	4 (6)	2 (13.3)	3 (5.2)	7 (8)	9–11 (9.2)
Abnormal	5–10 (9.7)	5–10 (9.7)	3–10 (8.5)	4–10 (7.9)	0–6 (7.4)	12–40 (10.1)
DNBC[c]						
90% lowest problem score	0–4 (89.6)	0–4 (90.3)	0–2 (81.9)	0–2 (89.6)	7–10 (93.3)	0–10 (88)
10% highest problem score	5–10 (10.4)	5–10 (7.7)	3–10 (18.1)	3–10 (10.4)	0–6 (6.7)	11–40 (12)

Banding scores (%).
[a]11–17 years. *N*= Boys: 843, girls: 853.
[b]10–12 years. *N*= Boys: 3322, girls: 3237.
[c]11 years. *N*= Boys: 21175, girls: 21720.

Generally, Arnfred's banding scores for the average group ranged more broadly leading to a relatively narrow range of scores identifying children at-risk for mental health problems. This suggests that the children from the DNBC, the Copenhagen Child Cohort 2000, the Danish National Institute of Social Research's cohort and Aarhus birth cohort appear to have fewer mental health problems than those in Arnfred's sample.

Table 3. Cut-off points for classification based on self-reported scales of the SDQ for adolescents aged 11–18.

	Emotional problems	Hyperactivity	Conduct problems	Peer problems	Pro-social behaviour	Total difficulties
			Boys			
Arnfred's norms[a]						
Close to average	0–3 (82)	0–6 (87.5)	0–3 (87.9)	0–3 (84.3)	6–10 (83.6)	0–13 (80.2)
Slightly raised/slightly lowered	4–5 (12.1)	7 (5.7)	4 (6.3)	4 (8.0)	5 (10.9)	14–16 (10)
High/low	6 (2.7)	8 (4.5)	5 (2.3)	5 (4.9)	4 (3.1)	17–19 (5.4)
Very high/very low	7–10 (3.2)	9–10 (2.3)	6–10 (2.8)	6–10 (2.8)	0–3 (2.4)	20–40 (4.6)
DNBC[b]						
90% lowest score	0–4 (88.1)	0–6 (90.9)	0–3 (87.8)	0–3 (85.7)	6–10 (88.2)	0–15 (89.4)
10% highest score	5–10 (11.9)	7–10 (9.1)	4–10 (12.2)	4–10 (14.3)	0–5 (11.8)	16–40 (10.6)
			Girls			
Arnfred's norms[a]						
Close to average	0–5 (80.6)	0–5 (83.6)	0–2 (83.1)	0–3 (84.9)	7–10 (83.5)	0–14 (80.6)
Slightly raised/slightly lowered	6–7 (13.7)	6 (6.4)	3 (10.5)	4 (7.6)	6 (8.8)	15–18 (10.1)
High/low	8 (3.3)	7 (4.7)	4 (3.1)	5 (4.2)	5 (4.8)	19–20 (4.5)
Very high/very low	9–10 (2.4)	8–10 (5.3)	5–10 (3.3)	6–10 (3.3)	0–4 (2.9)	21–40 (4.8)
DNBC[b]						
90% lowest problem score	0–7 (88)	0–6 (87)	0–3 (88.2)	0–4 (92.5)	7–10 (88.5)	0–18 (87.3)
10% highest problem score	8–10 (12)	7–10 (13)	4–10 (11.8)	5–10 (7.5)	0–6 (11.5)	19–40 (12.7)

Banding scores (%).
[a]11–17 years. *N* = Boys: 830, girls: 779.
[b]18 years. *N* = Boys: 17339, girls: 24602.

The discrepancies identified could be explained by several factors: First, Arnfred's population differs from the DNBC in some ways. Arnfred's population included children in special education settings where children are more likely to have neurodevelopmental difficulties than other children. Arnfred's population also included children born with rare diagnoses that presumably would impact behaviour, whereas these were excluded from the examined DNBC population. Furthermore, children in private day-care/schools were not a part of the study population in Arnfred's study population. Children in private day-care/schools in Denmark have a higher proportion of children with privileged parents [14, 15] and might therefore be expected to have fewer problems detected by the SDQ than the general population in Denmark [16]. Second, Arnfred's rather small sample lived in a single municipality, whereas children and adolescents in Niclasen's samples and the DNBC were recruited from municipalities across Denmark. Assens municipality may therefore not be representative of other municipalities in Denmark, as the participants in Arnfred's sample may experience more signs of mental health problems. A third factor that could partially explain the differences we observe between the three sources, is that the age groups we compare do not have exactly the same ages. Arnfred's age limits in his child/adolescent groups are much broader than the age limits in both Niclasen's and our DNBC sample. Moreover Arnfred's oldest age group ended at age 17 years, and we analysed a sample of participants who were invited for the data collection when turning 18 years of age.

Groups with low socioeconomic resources in terms of education, occupation, income and civil status are underrepresented in the DNBC compared to the background population [17–19]. When we transfer norms from Arnfred's sample containing children who are more likely to have mental health problems to samples consisting of more privileged and healthier children, we expect to observe inconsistencies similar to those presented in the result section. The use of Arnfred's norm scores would result in more conservative decisions about which children should be identified as abnormal/at-risk for mental health problems. A set of conservative banding scores decreases the risk of false-positive results in the category 'abnormal/at-risk'. In contrast, conservative banding scores would lead to a higher proportion of false-negatives wrongly placed in a 'borderline' category.

A limited number of European countries have determined and published national SDQ norms. Countries without national banding scores have to use banding scores from other comparable countries. We found examples of studies based on data from Sweden [20], Greenland [21] and the Netherlands [22] that refer to the Danish norms identified by Arnfred et al. 2019 [9]. It is therefore important that the Danish norms are as valid and representative as possible. The identified banding scores from our DNBC-sample are comparable with those reported by studies performed in other comparable northern countries such as Finland [23] and Sweden [24]. This supports us in our concern about transferring the published national norms without critical consideration and supports a need for confirmation of the current Danish SDQ norms. We recommend new estimations of norms in large Danish community samples, for example BørnUngeLiv [25], DNBC, the Copenhagen Child Cohort 2000, the Danish Future Occupation of Children and Adolescents cohort [26], the Vestliv cohort [27] as well as other existing data sources. The critical issue is that the sample is representative, or weighted, and of sufficient size to conduct narrow age specific banding scores. We would argue, for example, that there are important differences in the developmental status of children in the age ranges 2–6 and 11–17 respectively.

Conclusion

Our results demonstrate that irregularities exist when applying the existing Danish SDQ norms to a large-scale cohort sample in Denmark. The current norms should be used with caution, verified in other large samples and possibly revised.

Limitations

This study has some limitations: We have only presented a brief overview of the different banding scores from three different sources. Our examination did not include a comparison of the teacher-administered SDQ banding scores among children/adolescents nor an examination of the SDQ impact scale. We examined the banding scores without consideration of any clinical diagnosis, because we only had access to this information in the DNBC. Our aim was not to recommend another set of banding scores to identify children and adolescents at-risk of mental health problems, but we have demonstrated that banding scores are sensitive to the population that they are based on and there are clear inconsistencies between different samples from the Danish population.

Ethical approval and consent to participate

The DNBC was approved by the Committee on Biomedical Research Ethics under case no. (KF) 01–471/94 and the cohort was approved under ref. no 2008–54–0431 by Danish Data Protection Agency. All women who participated in the study gave informed written consent. This study was approved by the DNBC steering committee (ref. 2020–06) and by University of Copenhagen with case-no. 514–0488/20–3000.

Author contributions

PW, KSL, GO were involved in planning and supervised the work, ISR handled the data, performed the analysis and drafted the manuscript. All authors interpreted the results, worked and commented on the manuscript.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data Availability statement

This study is based on data from the Danish National Birth Cohort. Researchers can apply for use of these data at http://www.dnbc.dk.

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