In between looking and seeing: recognition, referral and assessment of children and adolescents' mental health problems at the interface of primary care and secondary mental healthcare

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Appendices

Supplementary material belonging to Study 1

Translation of the vignettes

The vignettes were created, pilot-tested and surveyed in the Dutch language. Since only Dutch speaking participants were surveyed, the vignette script has not been translated back and forth, and thus, differences in connotation of the translated symptom expressions and idioms exist.

Vignette 1-Somatic: Rene is the first of two children, ten years old and consulting you because of recurring earaches. You know Rene as a shy child who cooperates well. While you are examining the child's ears, the mother mentions that although Rene looks timid, Rene can certainly be temperamental, usually when they are in a hurry. When you enquire further, it turns out that the mother means that although Rene can be so calm and sit so quietly, Rene can also get pretty upset. About three times a week, or so. But "Luckily Rene also has many strong points". Even when Rene has not slept well because of the earaches, in the morning Rene goes to school as usual. Rene doesn't want to miss any school and wants to finish all the homework properly. Rene's study skills are good. The teacher thinks Rene is a smart child. She does say, however, that "Rene can respond rather impatiently if Rene does not have a handle on certain situations". In addition, tiredness and overweight are also issues. Rene apparently did not have a healthy diet, but now they are watching what Rene eats.

Vignette 2-Behavioural: Finn is eleven years old and received mental healthcare as an eight year old. This was after their home was broken into. Finn has a fear of pain, small spaces, and burglars. Finn's mother confirms that Finn is still troubled by this, has concentration problems, and she adds that dyslexia was also noted at that time. This has an impact on Finn's performance at school. When you ask how things are going at home, Finn's mother responds that Finn "is impulsive, pushes the boundaries, can be rude, and goes on and on about things". She says that Finn fell down the stairs at the age of two and she wonders whether this might have influenced the current behaviour. It appears that the parents often have rows and disagreements. When you ask Finn how Finn usually feels, the answer is "cheeky and cool". Further, there are issues with sleeping; Finn has difficulty letting go. With the exception of minor respiratory symptoms there are no other somatic issues.

Vignette 3-Mood: Alin is twelve years old, is starting 8th grade, and lives with parents and twin brothers aged 14 who are known to have bronchial hyper responsiveness. Except for some bowel problems at the age of four, Alin is not known to you with other health issues. Alin's mother, who attends the consultation with Alin, tells you she has become increasingly worried over the past few years. Alin has difficulties concentrating at school, has few friends, and can be difficult at home. Alin expects everything to be worse than it actually is and is apprehensive – about all kinds of things. Alin increasingly prefers being alone. If there are tensions, Alin seems unreachable. Alin's mother wonders whether these problems will pass. She says she has never experienced problems of this kind with her other two children. Alin seems not to let on to others that things aren't going well and is convinced that there are a lot of things Alin is not good at. When you ask, Alin does report feeling tired, restless, and unhappy.

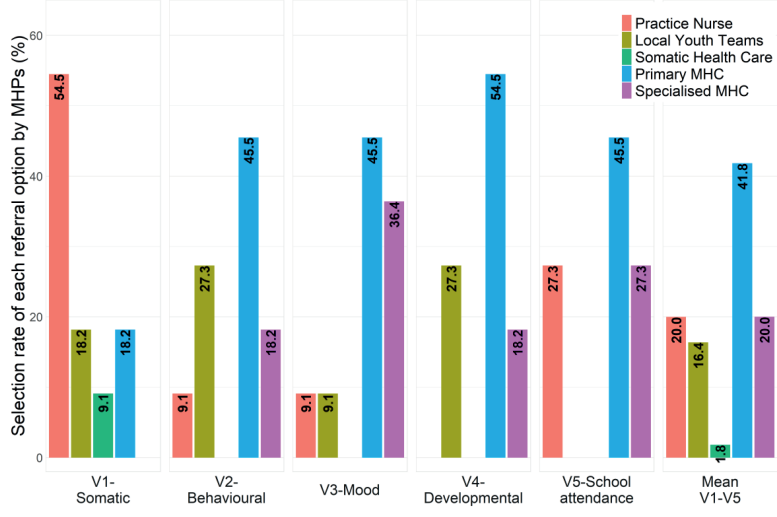
Vignette 4- Developmental: Lux is ten years old. Lux's mother turns to you for help because of increasing frustrations at home. She tells you that Lux has difficulty sharing with younger brother and seems to be controlling in friendships. With friends too this has sometimes led to problems interacting. Nevertheless, mother says that Lux is also concerned about little brother. Lux asks the parents questions about the brother's and other relation's health. The mother sees Lux as a child of a sensitive nature and with a strong will. Lux also had difficulty parting from parents when Lux went to

kindergarten. In the interaction with you, Lux initially comes across as rather passive, yet is able to develop a relation. You observe a somewhat restless, agitated attitude. When you ask how things are currently going at school, the mother says that Lux receives educational assistance for mild learning problems. Lux gets very stressed when things do not succeed. Lux tries to work neatly and carefully at school, though Lux is clearly easily distracted.

Vignette 5-Absenteeism: Jody is eleven years old and comes for a consultation because increasingly often, Jody does not manage to do a full day at school. Jody's parents are worried about this behaviour. The parents say that in recent months Jody has been crying a lot and has not been eating well. According to the teacher Jody is increasingly withdrawn and often seems not to finish the homework, but the parents say that Jody has never liked being the centre of attention. Otherwise there are no problems at school. They can't point to a specific incident that might have triggered these changes. Although two years ago Jody's family moved from the north of the country rather suddenly. The mother wonders whether Jody may have experienced this as traumatic and may still be troubled by it. Around that time Jody once fainted at home. Further there was nothing worrying up until now. Jody has always been a child who does well and wants to do well. It took some time after the relocation, but Jody is now best friends with two other children at school.

Demographical Characteristics of the Mental Health Professionals (MHPs)

Although all clinical psychologist and psychiatrist undergo a general training in the Netherlands, we asked MHPs what department they work for in order to have some insight in what problems they are particularly concerned with at the moment. A participation similar to what we see generally in psychiatry was found with three MHPs reporting affective disorders as their main focus, one developmental disorders, four comorbidity between psychiatric and somatic disorders, and one MHP employed at the department focusing on "comorbidity and complex problems within the primary support group". One MHP was affiliated to both latter departments. One MHP reported to have between 6-9 years of experience in this profession. Two MHPs reported to have 10 to 14 years of experience, four MHPs reported to have 15 to 19 years of experience, and another four to have more than 20 years of experience. All MHP in this validation sample were women. The gender distribution in the national MHP population is reported to be 5:1.



Supplementary Figure 1.MHPs' responses for the referral of each vignette

Supplementary Table 1. MHPs' selection rate of each disorder group per vignette

	V1-Somatic		V2-Behavioural		V3-Mood		V4-Developmental		V5-School attendance	
	First	Second	First	Second	First	Second	First	Second	First	Second
Anxiety	9.1	45.5	36.4	10.0	-	18.2	9.1	30.0	27.3	18.2
Trauma	-	-	-	20.0	-	-	-	-	-	63.6
Mood	9.1	-	-	-	63.6	18.2	-	10.0	63.6	9.1
Somatic	63.6	9.1	-	-	9.1	9.1	-	-	-	-
Eating	-	27.3	-	-	-	-	-	-	9.1	9.1
Autism	18.2	-	-	-	27.3	18.2	18.2	-	-	-
Attention-hyperactivity	-	-	27.3	10.0		9.1	54.5	30.0	-	-
Difficult behaviour	-	9.1	36.4	50.0	-	-	18.2	-	-	-
Typical development	-	-	-	-	-	-	-	-	-	-
No second complaint		9.1		10.0		27.3		30.0		-

Mental health professionals' selection rate of each disorder group per identification question of each vignette, shown as percentages. Responses were obtained from eleven MHPs on each question, except for ten responses on the second identification question of V2-Behavioural and V4-Developmental.

Supplementary material belonging to section "Results"

Tests of association between sample characteristics and the outcome measures

GPs' gender and years of experience did not show a relation with recognition and referral of anxiety. The tests were carried initially with the same number of levels as resulting from the survey (six levels for years of experience: 0-2, 3-5, 6-9, 10-14, 15-19, >20; six levels for recognition: 0 to 5). Since multiple cells had counts smaller than five analyses were recarried and depicted below with a median split for both variables. The median of the years of experience variable was >20 years of experience, and median recognition of anxiety was one; resulting in a binary median split. Analysis with median split did not change statistical significance of the results. Depicted below are the results of the tests for independence of gender and experience with (I) whether anxiety was recognized in any of the vignettes, (II) the referral options GPs chose in each of the vignettes, and (III) their explicit referral preferences for each of the disorder groups.

(I) GPs recognition of anxiety the five vignettes:
Gender: $\chi 2_{(1, n=211)} = 1.05$, $p = .31$; Experience: $\chi 2_{(1, n=228)} = .675$, $p = .411$.

(II) GPs answers for the referral of each vignette:
V_1 gender: $\chi 2_{(4, n=196)} = 2.25$, $p = .69$; experience: $\chi 2_{(4, n=212)} = 0.56$, $p = .97$
V_2 gender: $\chi 2_{(4, n=202)} = 2.63$, $p = .62$; experience: $\chi 2_{(4, n=219)} = 8.82$, $p = .07$
V_3 gender: $\chi 2_{(4, n=206)} = 2.40$ $p = .49$; experience: $\chi 2_{(4, n=223)} = 1.29$, $p = .86$
V_4 gender: $\chi 2_{(4, n=198)} = 2.17$, $p = .71$; experience: $\chi 2_{(4, n=214)} = 3.19$, $p = .53$
V_5 gender: $\chi 2_{(4, n=194)} = 7.85$, $p = .01$; experience: $\chi 2_{(4, n=210)} = 1.72$, $p = .79$

(III) GPs' referral preferences when they suspect:
Anxiety: gender: $\chi 2_{(4, n=206)} = 8.13$, $p = .09$, experience: $\chi 2_{(4, n=223)} = 7.32$, $p = .12$
Trauma: gender: $\chi 2_{(4, n=200)} = 1.18$, $p = .88$, experience: $\chi 2_{(4, n=216)} = 10.69$, $p = .03$
Mood: gender: $\chi 2_{(4, n=202)} = 0.92$, $p = .92$, experience: $\chi 2_{(4, n=219)} = 1.11$, $p = .89$
Somatic: gender: $\chi 2_{(4, n=194)} = 3.66$, $p = .45$, experience: $\chi 2_{(4, n=211)} = 3.79$, $p = .44$
Eating problems: gender: $\chi 2_{(4, n=202)} = 5.79$, $p = .22$, experience: $\chi 2_{(4, n=218)} = 5.18$, $p = .27$
Autism: gender: $\chi 2_{(4, n=197)} = 8.76$, $p = .07$, experience: $\chi 2_{(4, n=213)} = 13.58$, $p = .01$
Attention-hyperactivity: gender: $\chi 2_{(4, n=198)} = 7.67$, $p = .10$, experience: $\chi 2_{(4, n=213)} = 2.80$, $p = .59$
Difficult behaviour: gender: $\chi 2_{(4, n=198)} = 2.98$, $p = .56$, experience: $\chi 2_{(4, n=215)} = 3.69$, $p = .45$

Supplementary Table 2. Differences between GPs' and MHPs' recognition of anxiety in each of the five vignettes

	GPs' recognition	MHPs' recognition	Chi-square df=1	*P-value*
V1-Somatic	13 (5.7%)	6 (54.5%)	34.21	< .0001
V2-Behavioural	76 (33.8%)	5 (45.5%)	0.63	.426
V3-Mood	31 (13.7%)	2 (18.2%)	0.18	.653
V4-Developmental	20 (9.0%)	4 (36.4%)	8.49	.018
V5-School Attendance	27 (11.9%)	5 (45.5%)	10.08	.001

Selection frequency (%) of anxiety over the two identification questions shown in percentages per vignette. Excluding cases with a missing response on both identification questions of a vignette resulted in the following sample sizes for the GPs: V1-Somatic= 228, V2-Behavioural= 225, V3-Mood = 227, V4-Developmental= 222, V5-School Attendance= 226. Sample size for the MHPs=11. Fisher exact values are shared for V3-Mood and V4-Developmental as a result of small cell sizes (n<5).

Differences in the selection rate of the disorder groups

With a total of 229 respondents and 17 times a missing response on both identification questions of a vignette a total of 1128 possibilities (229*5-17) to label a vignette with each disorder group emerged for GPs. The total number of times MHPs could opt for each disorder group was 55 (11*5 vignettes). To investigate the recognition of each disorder group in the mixed vignettes within and between both groups of professionals, these totals (1128 and 55) were set against the number of times each disorder group was chosen. Given the small sample size and the multiple comparisons made, Bonferroni corrections were applied and the p-value was set at 0.05/24= .002. Analysis revealed that the GPs recognized anxiety less often than behavioural, mood, developmental and trauma related problems. Analysis of MHPs responses revealed that they recognized most frequently anxiety and mood problems. Comparison of GPs' and MHPs' recognition rate of each disorder group revealed that they differed only regarding anxiety (supplementary Table 3).

Supplementary Table 3. Differences between GPs and MHPs selection frequency of the disorder groups

	GPs' recognition	MHPs' recognition	OR (95% CI)	Chi-square value df=1	*P-value*
Anxiety	167 (14.8%)	22 (40.0%)	0.26 (0.15 to 0.46)	24.80	<.000001
Trauma	238 (21.1%)	9 (16.4%)	1.37 (0.66 to 2.83)	0.71	.3988
Mood	290 (25.7%)	19 (34.5%)	0.66 (0.37 to 1.16)	2.12	.1452
Somatic	87 (7.7%)	10 (18.2%)	0.38 (0.18 to 0.77)	7.64	.0057
Eating	60 (5.3%)	5 (9.1%)	0.56 (0.22 to 1.46)	1.44	.2307
Autism	253 (22.4%)	9 (16.4%)	1.35 (0.65 to 2.79)	1.119	.2901
Attention-hyperactivity	279 (24.7%)	14 (25.5%)	0.96 (0.52 to 1.79)	0.015	.9038
Difficult behaviour	332 (29.4%)	12(21.8%)	1.49 (0.78 to 2.87)	1.47	.2247
Typical development	177 (15.7%)	0 (0%)			
No second complaint group	184 (16.3%)	8 (14.5%)			

Supplementary Table 4. Referral of the vignettes by GPs who recognized anxiety and who did not

		Practice Nurse	Local Youth Teams	Somatic Healthcare/ Hospital	Primary Mental Healthcare	Specialised Mental Healthcare		Referral to mental health-care OR (95% CI), *P-value*
V_1	Selected	9 (69.2%)	3 (23.1%)	1 (7.7%)	0 (0.0%)	0 (0.0%)	**V_1**	0.03 (0.01 to 0.07), < .0001
	Not selected	117 (58.5%)	62 (31.0%)	13 (6.5%)	3 (1.5%)	5 (2.5%)		
V_2	Selected	13 (17.3%)	17 (22.7%)	29 (38.7%)	16 (21.3%)	0 (0%)	**V_2**	10.12 (4.53 to 22.59), < .0001
	Not selected	31 (21.8%)	37 (26.1%)	37 (26.1%)	36 (25.4%)	1 (0.7%)		
V_3	Selected	12 (40.0%)	4 (13.3%)	8 (26.7%)	6 (20.0%)	0 (0.0%)	**V_3**	11.37 (5.18 to 24.94), < .0001
	Not selected	48 (24.9%)	24 (12.4%)	65 (33.7%)	54 (28.0%)	2 (1.0%)		
V_4	Selected	8 (42.1%)	4 (21.1%)	5 (26.3%)	2 (10.5%)	0 (0.0%)	**V_4**	3.95 (1.73 to 9.02), = .001
	Not selected	67 (35.1%)	53 (27.7%)	46 (24.1%)	23 (12.0%)	2 (1.0%)		
V_5	Selected	14 (58.3%)	5 (20.8%)	3 (12.5%)	1 (4.2%)	1 (4.2%)	**V_5**	2.35 (0.98 to 5.63),= .055
	Not selected	105 (56.8%)	42 (22.7%)	23 (12.4%)	4 (2.2%)	11 (5.9%)		
Mean V_1-V_5	Selected	45.4%	20.2%	22.4%	11.2%	0.8%	**R**	0.70 (0.42 to 1.18), = .185
	Not selected	39.4%	24.0%	20.6%	13.8%	2.3%		

Selection frequency (%) of each referral option per vignette partitioned by general practitioners who selected anxiety and who did not. OR= odds ratio as obtained from the logistic multilevel analysis with the outcome measure whether a referral to mental healthcare was made, and the predictors: vignette (V_1 to V_5) and whether anxiety was recognized (R).

Supplementary Table 5. Results of the multilevel analysis on referral to mental healthcare

Mental health disorder	OR	95% CI	*P-value*
Anxiety	1.86	1.38 to 2.50	<.0001
Trauma	2.46	1.57 to 3.85	<.0001
Mood	1.03	0.69 to 1.55	.881
Somatic	0.27	0.18 to 0.40	<.0001
Eating	2.00	1.30 to 3.08	<.001
Autism	0.42	0.28 to 0.62	<.0001
Attention-hyperactivity	1.57	1.03 to 2.39	<.037
Difficult behaviour	0.07	0.04 to 0.11	<.0001

Supplementary Table 5 depicts the odds ratios (ORs) of referral to mental healthcare (yes/no) for each mental health disorder separately as reported by GPs when asked how they generally tend to manage children they suspect to have a mental health disorders. GPs responses for anxiety were included as the baseline. GPs chose between five options, which were combined into yes: primary mental healthcare and specialised mental healthcare, versus no: watchful waiting, practice nurse and local youth teams.

Supplementary material belonging to Study 2

Supplementary Table 1. Origin of the referral letters N=1259

	n (%)
General Practitioner (GP)	689 (54.7)
GP and another referrer	34 (2.7)
Specialists	
Psychiatry	61 (4.8)
Pediatrics	172 (13.7)
Rehabilitation doctors	13 (1.0)
Others	30 (2.4)
Local youth teams	
Youth and family centres	217 (17.2)
Municipal Health services	48 (3.8)
Juvenile probation officer	29 (2.3)

In the Netherlands, a formal referral to child and adolescent psychiatry proceeds either via general practice, specialized health centers (hospitals), the local youth welfare offices, or via youth protection boards. A total of 723 (57.4%) RLs were from general practice, and 34 of these cases had a RL from a GP and another referrer. For these cases we extracted only information from the RL originating from general practice.

Supplementary Table 2. Chance corrected agreement

	κ (95% CI)
Anxiety disorders	.81 (.73 - .86)
Depressive disorder	.82 (.71 - .94)
PTSD	.77 (.57 - .96)
Eating disorders	.87(.69 - 1.00)
ASD	.90 (.82 - .98)
ADHD	.90 (.83 - .97)
Behaviour	.77 (.63 - .66)

Chance corrected agreement, Kappa values, per disorder group computed over a random selection of 150 RLs that were coded by the author who coded all RLs and the three second coders who each coded a set of 50 letters.

Supplementary Table 4. How often and which ICPC-codes were written in referral letters?

	First	Second	Third	Fourth	Fifth
A Unspecified	23 (3.2)	20 (2.8)	9 (1.2)	6 (0.8)	4 (0.6)
B Blood and Immune mechanism	1 (0.1)	1 (0.1)	-	-	1 (0.1)
D Digestive	9 (1.2)	7 (1.0)	7 (1)	-	2 (0.3)
F Eye	6 (0.8)	3 (0.4)	2 (0.3%	3 (0.4)	-
H Ear	5 (0.7)	3 (0.4)	2 (0.3)	4 (0.6)	1 (0.1)
K Cardiovascular	4 (0.5)	5 (0.7)	1 (0.1)	1 (0.1%	-
L Musculoskeletal	8 (1.1)	13 (1.8)	8 (1.1)	1 (0.1)	4 (0.6)
N Neurological	10 (1.4)	5 (0.7)	5 (0.7)	3 (0.4)	-
P Psychological	176 (24.3)	65 (9.0)	29 (4.0)	11 (1.5)	5 (0.7)
R Respiratory	34 (4.7)	29 (4.0)	20 (2.8)	13 (1.8)	2 (0.3)
S Skin	20 (2.8)	21 (2.9)	11 (1.5)	5 (0.7)	5 (0.7)
T Endocrine/ metabolic	16 (2.2)	9 (1.2)	3 (0.4)	1 (0.1)	1 (0.1)
U/W Urological/ Pregnancy	2 (0.2)	2 (0.3)	7 (1.0)	-	1 (0.1)
X/Y Female/ Male genital	-	5 (0.7)	2 (0.3)	2 (0.3)	1 (0.1)
Z Social problems	17 (2.4)	6 (0.8)	2 (0.3)	1 (0.1)	2 (0.3)
No ICPC-code written in RL	392 (54.2)	529 (73.2)	617 (85.3)	672 (92.9)	695 (96.1)

Table 4 depicts the number (%) of ICPC-codes written in RLs. Frequently issued specific codes by the referrer were A12-Allergy (n=18), R96-Asthma (n=46), and S87-Eczema (n=37)[48]. Frequencies are not depicted on the level of the specific codes as a result of low frequencies and the differences we observed between these registered ICPC-codes and their accompanying short textual description (also written in RLs). Latter suggests probable unreliable use of the ICPC-code at that level (as discussed in the discussion section in the main manuscript).

Supplementary Table 5. Odds of classification per disorder group

		OR	95% CI
Anxiety disorders	RL	5.93	3.73 – 9.43
	RL+	4.76	2.90 – 7.83
	Age	1.15	1.07 – 1.24
	Gender	1.23	0.76 – 1.97
	History	1.28	0.72 – 2.26
	CGAS	1.00	0.97 – 1.04
Depression	RL	10.89	6.73 – 17.62
	RL+	4.79	2.83 – 8.10
	Age	1.42	1.26– 1.59
	Gender	1.70	0.98 – 2.96
	History	1.07	0.56 – 2.03
	CGAS	0.98	0.95 – 1.02
PTSD	RL	29.79	11.58 – 76.63
	RL+	45.47	15.31 – 135.06
	Age	1.10	0.95 – 1.28
	Gender	2.63	0.89 –7.78
	History	2.41	0.49 – 11.73
	CGAS	0.93	0.86 – 1.00
Eating disorders	RL	808. 36	170.43 – 3834.19
	RL+	681.78	95.95 – 4844.36
	Age	1.55	0.97 – 2.50
	Gender	3.10	0.26 – 36.67
	History	1.10	0.18 – 6.84
	CGAS	0.90	0.81 – 1.01
Autism spectrum disorders	RL	5.06	3.57 – 7.16
	RL+	5.17	3.48– 7.68
	Age	0.94	0.89 – 0.99
	Gender	0.47	0.31 – 0.71
	History	1.46	0.94 – 2.25
	CGAS	0.93	0.91 – 0.96
ADHD	RL	6.11	4.36 – 8.56
	RL+	7.39	5.09 – 10.74
	Age	0.91	0.86 – 0.96
	Gender	0.59	0.40 – 0.88
	History	0.89	0.58 – 1.35
	CGAS	1.00	0.97 – 1.03
Behavioural disorders	RL	6.02	3.11 – 11.66
	RL+	7.14	3.45 – 14.77
	Age	1.04	0.94 – 1.16
	Gender	1.08	0.54 – 2.17
	History	1.86	0.74 – 4.68
	CGAS	0.95	0.90 – 0.99

Values Table 5 depict the odds ratios (OR) resulting from logistic regression analyses with disorder group as outcome. PTSD= Post traumatic stress disorder. ADHD= attention-deficit hyperactivity disorders. Each upper row (RL) depicts the univariate analysis with only referral letter as predictor. Second to fifth rows (RL+) depict odds corrected for the main effects of age, gender, treatment history, and CGAS score. Age and CGAS were included as continuous variables. The reference for gender are boys. Psychiatric treatment history is included with '0 no treatment history' being the reference. In a third block the interaction terms RL*age, RL*gender, RL*history and RL*CGAS were added to test for the possibility that some disorder groups are mentioned more often in RLs depending on these factors. No significant interaction effects were found, except for an indication of ADHD*age (OR=1.14, 95% CI 1.03-1.27, *p*=.026).

Supplementary Table 6. Accuracy metrics for the most prevalent psychiatric disorder groups

		Anxiety disorders n=105	Mood disorders n=92	PTSD n=21	Eating disorders n=27	ASD n=214	ADHD n=243	Behavioural Disorders n=43	Personality disorder n=34	Psychosomatic disorders n=17	Re. attachm. & Disin. s. eng. d. n=16
Anxiety ICPC n=111	TP (Se, PPV)	**44 (41.9, 39.6)**	17 (18.5, 15.3)	3 (14.3, 2.7)	3 (11.1, 2.7)	28 (13.1, 25.2)	28 (11.5, 25.2)	5 (11.6, 4.5)	7 (20.6, 6.3)	4 (23.5, 3.6)	3 (18.8, 2.7)
	st.adj.res.	**8.2**	0.9	-0.1	-0.6	-1.1	-2.0	-0.7	0.9	0.9	0.4
	TN (Sp)	**551 (89.2)**	537 (85.1)	594 (84.6)	588 (84.5)	426 (83.7)	397 (82.7)	574 (84.4)	585 (84.9)	599 (84.8)	599 (84.7)
Mood ICPC n=148	TP (Se, PPV)	**36 (34.3, 24.3)**	**59 (64.1, 39.9)**	6 (28.6, 4.1)	7 (25.9, 4.7)	35 (16.4, 23.6)	30 (12.3, 20.3)	5 (11.6, 3.4)	**15 (44.1, 10.1)**	7 (41.2, 4.7)	2 (12.5, 1.4)
	st.adj.res.	**3.8**	**11.1**	0.9	0.7	-1.8	-3.9	-1.5	**3.5**	2.1	-0.8
	TN (Sp)	**506 (81.9)**	**542 (85.9)**	560 (79.8)	555 (79.7)	396 (77.8)	362 (75.4)	537 (79.0)	**556 (80.7)**	565 (80.0)	561 (79.3)
Trauma ICPC n=36	TP (Se, PPV)	7 (6.7, 19.4)	2 (2.2, 5.6)	**11 (52.4, 30.6)**	1 (3.7, 2.8)	3 (1.4, 8.3)	8 (3.3, 22.2)	5 (11.6, 13.9)	3 (8.8, 8.3)	1 (5.9, 2.8)	1 (6.3, 2.8)
	st.adj.res.	0.9	-1.3	**10.1**	-0.3	-2.9	-1.5	2.1	1.1	0.2	0.2
	TN (Sp)	589 (95.3)	597 (94.6)	**677 (96.4)**	661 (95.0)	476 (93.5)	452 (94.2)	649 (95.4)	656 (95.2)	671 (95.0)	672 (95.0)
Eating ICPC n=37	TP (Se, PPV)	7 (6.7, 18.9)	6 (6.5, 16.2)	1 (4.8, 2.7)	**25 (92.6, 67.6)**	4 (1.9, 10.8)	1 (0.4, 2.7)	1 (2.3, 2.7)	4 (11.8, 10.8)	0 (-)	0 (-)
	st.adj.res.	0.8	0.7	-0.1	**21.0**	-2.6	-4.1	-0.9	1.8	-1.0	-0.9
	TN (Sp)	589 (95.3)	601 (95.2)	667 (95.0)	**684 (98.3)**	476 (93.5)	444 (92.5)	644 (94.7)	656 (95.2)	669 (94.8)	670 (94.8)
Autism ICPC n=215	TP (Se, PPV)	18 (17.1, 8.4)	14 (15.2, 6.5)	1 (4.8, 0.5)	1 (3.7, 0.5)	**117 (54.7, 54.4)**	68 (28.0, 31.6)	9 (20.9, 4.2)	4 (11.8, 1.9)	1 (5.9, 0.5)	4 (25.0, 1.9)
	st.adj.res.	-3.1	-3.3	-2.5	-3.0	**9.5**	-0.7	-1.3	-2.3	-2.2	-0.4
	TN (Sp)	421 (68.1)	430 (68.1)	488 (69.5)	482 (69.3)	**411 (80.7)**	333 (69.4)	474 (69.7)	478 (69.4)	492 (69.7)	496 (70.2)
ADHD ICPC n=270	TP (Se, PPV)	20 (19.0, 7.4)	16 (17.4, 5.9)	6 (28.6, 2.2)	6 (22.2, 2.2)	70 (32.7, 25.9)	**158 (65.0, 58.5)**	11 (25.6, 4.1)	4 (11.8, 1.5)	1 (5.9, 0.4)	5 (31.3, 1.9)
	st.adj.res.	-4.2	-4.2	-0.8	-1.7	-1.7	**10.9**	-1.6	-3.2	-2.7	-0.5
	TN (Sp)	368 (59.5)	377 (59.7)	438 (62.4)	432 (62.1)	309 (60.7)	**368 (76.7)**	421 (61.9)	423 (61.4)	437 (61.9)	442 (62.5)
Behavi-oural ICPC n=203	TP (Se, PPV)	20 (19.0, 9.9)	11 (12.0, 5.4)	5 (23.8, 2.5)	1 (3.7, 0.5)	75 (35.0, 36.9)	64 (26.3, 31.5)	**29 (67.4, 14.3)**	3 (8.8, 1.5)	1 (5.9, 0.5)	**10 (62.5, 4.9)**
	st.adj.res.	-2.2	-3.7	-0.4	-2.9	2.7	-0.7	**5.9**	-2.6	-2.1	**3.1**
	TN (Sp)	435 (70.4)	439 (69.6)	504 (71.8)	494 (71.0)	381 (74.9)	341 (71.0)	**506 (74.4)**	489 (71.0)	504 (71.4)	**514 (72.7)**
Persona-lity ICPC n=52	TP (Se, PPV)	9 (8.6, 17.3)	**15 (16.3, 28.8)**	**5 (23.8, 9.6)**	1 (3.7, 1.9)	12 (5.6, 23.1)	16 (6.6, 30.8)	6 (14.0, 11.5)	**8 (23.5, 15.4)**	1 (5.9, 1.9)	**9 (56.3, 17.3)**
	st.adj.res.	0.6	**3.6**	**3.0**	-0.7	-1.1	-0.5	1.8	**3.8**	-0.2	**7.7**
	TN (Sp)	575 (93.0)	**594 (94.1)**	**655 (93.3)**	645 (92.7)	469 (92.1)	444 (92.5)	634 (93,2)	**645 (93.6)**	655 (92.8)	**664 (93.9)**
Somati-sation ICPC n=32	TP (Se, PPV)	8 (7.6, 25.0)	**11 (12.0, 34.4)**	0 (-)	0 (-)	8 (3.7, 25.0)	4 (1.6, 12.5)	0 (-)	1 (2.9, 3.1)	**5 (29.4, 15.6)**	0 (-)
	st.adj.res.	1.7	**3.8**	-1.0	-1.1	-0.6	-2.6	-1.5	-0.4	**5.1**	0.9
	TN (Sp)	594 (96.1)	**610 (96.7)**	670 (95.4)	664 (95.4)	485 (95.3)	452 (94.2)	648 (95.3)	658 (95.5)	**679 (96.2)**	675 (95.5)

Columns: frequency of diagnoses as classified in specialized mental healthcare. Rows: frequency of tentative diagnoses in RLs. TP= true positives, number of youth that had an indication of the diagnosis they are classified with in their RLs. Se= sensitivity, ratio TPs to the frequency of the diagnoses, in percentages. PPV= positive predictive value, ratio TPs to the frequency of diagnoses in RLs. St.adj.res.= standardized adjusted residual, computed as a measure of co-occurrence beyond chance. Depicts the discrepancy between observed and expected values and suggest statistical significance at the level of $p<.05$ when it exceeds $|1.96|$. Given the many comparisons made, we set a higher boundary of $|3.0|$.[1] TN= true negatives, number of youth without the classification and no indication in the RL. Sp= specificity, ratio TN to the whole sample without the disorder group, in percentages. ASD=autism spectrum disorders. ADHD= attention-deficit hyperactivity. Re. attachm. & Disin. s. eng. d.= reactive attachment & disinhibited social engagement disorder.

Results suggest that a quarter of children referred for mood problems were later classified with an anxiety disorder (24.3%, 36/105). The reverse association, i.e. referred with anxiety then classified with depression, was not foud. Nor was it accounted for by co-occurrence of depression in those classified with an anxiety disorder: after exclusion of the comorbid cases (n=16) the number of children with anxiety disorders that were referred for depressive disorders remained similar (28.1%, 25/89). A similar pattern was seen for those eventually diagnosed with behavioural disorders, as they were equally likely to be referred for suggested behavioural problems (14.3%), and or trauma (13.9%, 5/43). Again this association remained after exclusion of the cases with comorbid PTSD (16.0%, 4/25). Although high raw values were found for some other disorder groups, the frequencies were no more than what could be expected by chance.

Assuming that the reason of consult for Reactive attachment disorder and Disinhibited social engagement disorder might differ from those with PTSD, we included only PTSD from the Trauma and stressor-related disorders chapter in the tabulation with indications of trauma made in RLs. Adjustment disorders were not cross-tabulated as a result of their small sample size and since they can not be the only diagnosis in, or reason of referral to, specialized mental healthcare according to the Dutch legislation. For their relative severe nature, personality disorders were mentioned relative frequently in the RLs, but had a low sensitivity (23.5%). A suggestion of personality or attachment problems in RLs was significantly related to a classification of depression (28.8%) and PTSD (9.6%). This association decreased with about a third, to respectively 20.5% (9/44, st.adj.res.=2.1.) and 6.8% (3/44, st.adj.res.=2.0), when those with a co-occuring personality disorders were excluded. An indication of somatisation disorder in RLs was to some extent related to a later classification of somatisation disorder (PPV=15.6%). When next to somatisation disorder (which has a specific ICPC-code: P75), other bodily symptoms were also counted as an indication of somatic symptom and related disorders, both the sensitivity and PPV increased, to respectively 58.8% (10/17), and 25% (10/40). This (combining P75-somatisation disorder and indications of other bodily symptoms and physical complaints) did not change associations with other disorder groups.

Supplementary Table 7. Cross tabulation of reasons of referral and clinical status for the low prevalence disorder groups that were not included in the main manuscript

	PPV of the disorder specific labels	Sensitivity when all labels from the chapter are combined
Intellectual disability	1/8 (12.5)	16/21 (76.2)
Communication disorder	1/12 (8.3)	17/18 (94.4)
Motor disorders	5/ 14 (35.7)	11/14 (78.6)
Specific learning disorder	11/30 (36.7)	28/38 (73.7)
+ Other Neurodevelopmental Disorders + ASD + ADHD	322/435 (74.0)	
+ high IQ	323/439 (73.6)	
Separation anxiety disorder	-	4/8 (50.0)
Specific phobia	0/2 (0.0)	2/6 (33.30
Social anxiety disorder	1/7 (14.3)	10/16 (62.5)
Panic disorder	1/5 (20.0)	5/8 (62.5)
Agoraphobia	-	1/1 (100.0)
Generalized anxiety disorder	0/2 (0.0)	24/47 (51.1)
Anxiety disorder not otherwise specified	-	6/28 (21.4)
OCD	5/15 (33.3)	5/8 (62.5)

Separation anxiety disorder, agoraphobia, and anxiety disorder NOS do not have specific ICPC-codes. Hence no disorder specific PPVs' are depicted in these rows. Sensitivity is depicted on the level of the neurodevelopmental disorders chapter, the anxiety disorders chapter and for obsessive compulsive disorders (including trichotillomania n=2). Extant yet infrequent reasons of referral were emotion dysregulation (n=21), self-image (19) and game addiction (4).[2]

Supplementary Table 8. Extended table reasons of referral per disorder groups

	Anxiety disorders n=105	Mood disorders n=92	PTSD n=21	Eating disorders n=27	ASD n=214	ADHD n=243	Behavioral Disorders n=43
Study problems	11 (13.1%)	5 (6.0%)	1 (1.2%)	2 (2.4%)	32 (38.1%)	39 (46.4%)	7 (8.3%)
n=84 St. adj. res.	-0.4	-2.0	-1.0	-0.7	1.8	2.6	1.0
School attendance problems	12 (42.9%)	8 (28.6%)	0	0	7 (25.0%)	4 (14.3%)	0
n=28 St. adj. res.	4.3	2.6	-0.9	-1.1	-0.5	-2.2	-1.4
Perfectionism/ fear of failure	6 (30.0%)	3 (15.0%)	1 (5.0%)	1 (5.0%)	6 (30.0%)	4 (20.0%)	1 (5.0%)
n=20 St. adj. res.	2.0	0.3	0.6	0.3	0.0	-1.3	-0.2
High IQ	4 (25.0%)	2 (12.5%)	0	0	4 (25.0%)	4 (25.0%)	2 (12.5%)
n=16 St. adj. res.	1.2	0.0	0.7	-0.8	-0.4	-0.7	1.1
Intellectual disabilities	0	1 (12.5%)	1(12.5%)	0	3 (37.5%)	2 (25.0%)	0
n=8 St. adj. res.	-1.2	0.0	1.6	-0.6	0.5	-0.5	-0.7
Learning disorders	0	0	0	0	8 (26.7%)	16 (53.3%)	1 (3.3%)
n=30 St. adj. res.	-2.3	-2.1	-1.0	-1.1	-0.4	2.3	-0.6
Communication problems	1 (8.3%)	0 (0.0%)	0	0	5 (41.7%)	5 (41.7%)	0
n=12 St. adj. res.	-6	-1.3	-0.6	-0.7	0.9	0.6	-0.9
Somatic symptoms	8 (25.0%)	11 (34.4%)	0	0	8 (25.0%)	4 (12.5%)	0
n=32 St. adj. res.	1.7	3.8	-1.0	-1.1	-0.6	-2.6	-1.5
Headaches	0	2 (28.6%)	0	0	0	0	0
n=7	-1.1	1.3	-0.5	-0.5	-1.7	-1.9	-0.7
Pain-Fatigue	6 (35.3%)	6 (35.3%)	0	0	6 (35.3%)	3 (17.6%)	0
n=17	2.5	2.8	-0.7	-0.8	0.5	-1.4	-1.0
Stomach/ Bowel	2 (22.2%)	3 (33.3%)	0	0	2 (22.2%)	0	0
n=9	0.7	1.9	-0.5	-0.6	-0.5	-2.1	-0.8
Fainting/ Powerlessness	2 (66.7%)	1 (33.3%)	1 (33.3%)	1 (33.3%)	0	0	0
n=3	2.6	1.1	3.1	2.7	-1.1	-1.2	-0.4
Hyperventilation	1 (50.0%)	0	0	0	0	1 (50.0%)	0
n=2	1.4	-0.5	-0.2	-0.3	-0.9	0.5	-0.4
Problems Sleeping	4 (22.2%)	4 (22.2%)	2 (11.1%)	1 (5.6%)	2 (11.1%)	7 (38.9%)	0
n=18 St. adj. res.	0.9	1.2	2.1	0.4	-1.7	0.5	-1.1
Suicidal ideation	10 (18.9%)	23 (43.4%)	1 (1.9%)	0	14 (26.4%)	8 (15.1%)	2 (3.8%)
n=53 St. adj. res.	0.9	7.0	-0.5	-1.5	-0.5	-3.0	-0.7
Self Harm	7 (25.0%)	12 (42.9%)	3 (10.7%)	3 (10.7%)	8 (28.6%)	6 (21.4%)	1 (3.6%)
n=28 St. adj. res.	1.6	4.9	2.5	2.0	-0.1	-1.4	-0.5
(Sexual) Violence	1 (12.5%)	1 (12.5%)	5 (62.5%)	1 (12.5%)	0	1 (12.5%)	0
n=8 St. adj. res.	-2.0	0	10.1	1.3	-1.8	-1.3	-0.7
Problems with parents	15 (17.2%)	14 (16.1%)	8 (9.2%)	3 (3.4%)	16 (18.4%)	25 (28.7%)	11 (12.6%)
n=87 St. adj. res.	0.8	1.0	3.7	-0.2	-2.4	-1.3	2.8
Bullied-Social relatedness	5 (9.8%)	6 (11.8%)	1 (2.0%)	1 (2.0%)	20 (39.2%)	22 (43.1%)	1 (2.0%)
n=51 St. adj. res.	-1.0	-0.2	-4.0	-0.7	1.6	1.5	-1.2

Frequency (%) of the reasons of referral per disorder group, i.e. referred with the reason of referral in the row and classified with the disorder group in de column. Below each row percentage are standardized adjusted residual values depicted. A case could be referred for multiple reasons as well as be classified with multiple disorders.

References belonging to supplementary material of study 2

[1] Haberman, S. J., *Adjusted st. res. the Analysis of Frequency Data,*. 1974, Chicago: University of Chicago Press.

[2] Scottish Association for Mental Health and Information Services Division Scotland and NIHS, *Rejected Referrals Child and Adolescent Mental Health Services (CAMHS): A qualitative and quantitative audit*, Group Scotland, T. S., Edinburgh EH6 5NA PPDAS433246 (06/18), Editor. 2018, The Scottish Government.

Supplementary material belonging to Study 3

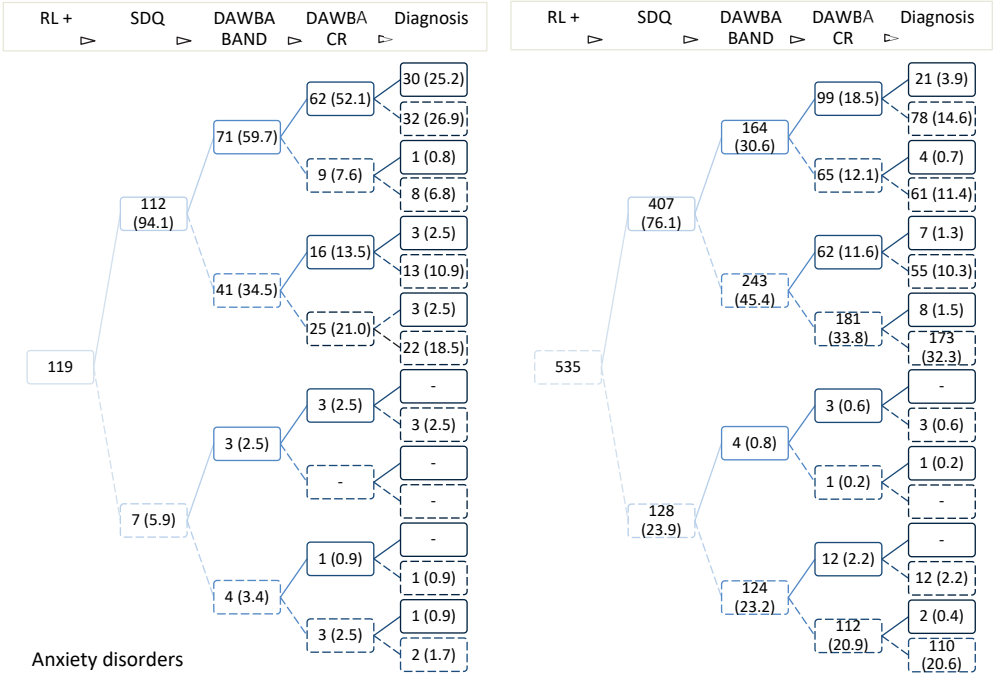
Supplementary table 1. Two by two cross-tabulation of the instruments per disorder group presenting positive predictive values

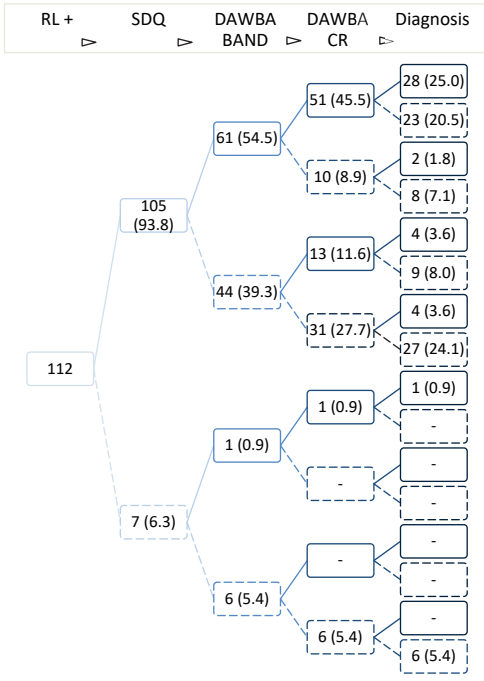
		Anxiety disorders		Depressive disorders		ASD		ADHD		Behaviour disorders	
		+	-	+	-	+	-	+	-	+	-
RL	+	38 (31.9)	81 (68.1)	39 (34.8)	73 (65.2)	108 (54.8)	89 (45.2)	114 (53.5)	99 (46.5)	26 (14.3)	156 (85.7)
	-	43 (8.0)	492 (92.0)	26 (4.8)	516 (95.2)	89 (19.8)	361 (80.2)	90 (20.5)	350 (79.5)	18 (3.8)	455 (96.2)
SDQ	+	77 (14.8)	442 (85.2)	62 (11.9)	457 (88.1)	140 (40.7)	204 (59.3)	181 (44.0)	230 (56.0)	38 (10.4)	328 (89.2)
	-	4 (3.0)	131 (97.0)	3 (2.2)	132 (97.8)	57 (18.8)	246 (81.2)	23(9.5)	219 (90.5)	6 (2.1)	283 (97.9)
Band	+	57 (23.6)	185 (76.4)	45 (32.4)	94 (67.6)	18 (78.3)	5 (21.7)	121 (60.8)	78 (39.2)	16 (6.6)	225 (93.4)
	-	24 (5.8)	388 (94.2)	20 (30.8)	495 (96.1)	179 (28.7)	445 (71.3)	83 (18.3)	371 (81.7)	28 (6.8)	384 (93.2)
CR	+	62 (24.2)	194 (75.8)	49 (32.0)	104 (68.0)	151 (49.5)	154 (50.5)	170 (51.8)	158 (48.2)	26 (11.5)	200 (88.5)
	-	19 (4.8)	379 (95.2)	16 (3.2)	485 (96.8)	46 (13.5)	296 (86.5)	34 (10.5)	291 (89.5)	18 (4.2)	411 (95.8)

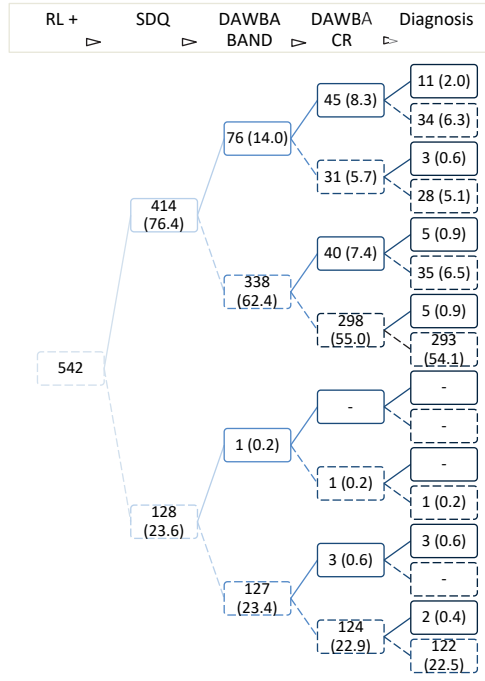
Frequency (%) of the positive and negative indications made per instruments and per disorder group, as a ratio of the total number of positive and negative indications made in the considering instrument. Number of diagnoses and sample size were as follows: anxiety disorders n=81 and N=654; depressive disorder n=65 and N=654, autism spectrum disorders (ASD) n=197 and N=647; attention-deficit hyperactivity disorder (ADHD) n=204 and N=653; behaviour disorders n=44 and N=655.

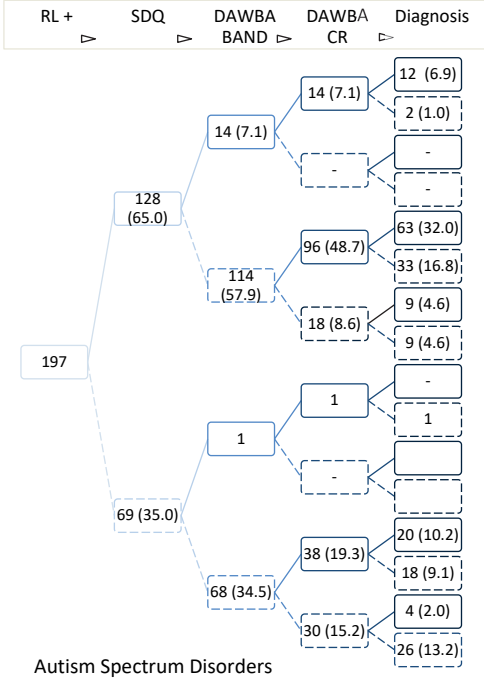
Supplementary Figure 1 Diagnostic trajectory

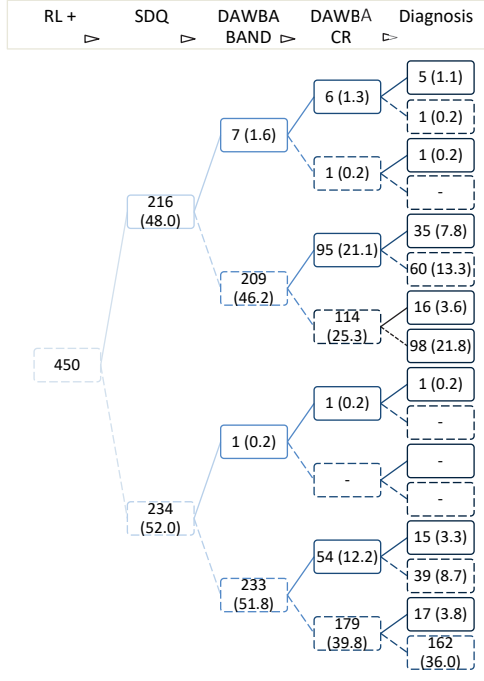
Number (%) of cases detected through RLs, SDQ, DAWBA band, and CR scores, per disorder group, as a ratio of the total frequency of the positive RLs (figure on the left) or negative RLs (right). The continuous lines present inflow, i.e. those that score positive on the concerning instrument. The dotted lines present outflow, i.e. those that score negative on the concerning instrument. Computed in the dataset with complete datapoints. Number of datapoints (N) for Anxiety: 654, Depression: 654, ASD:647, ADHD: 551, Behaviour disorders: 655.



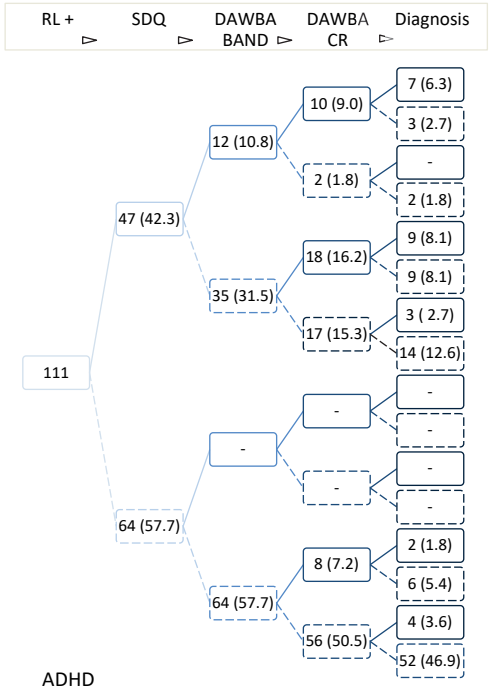




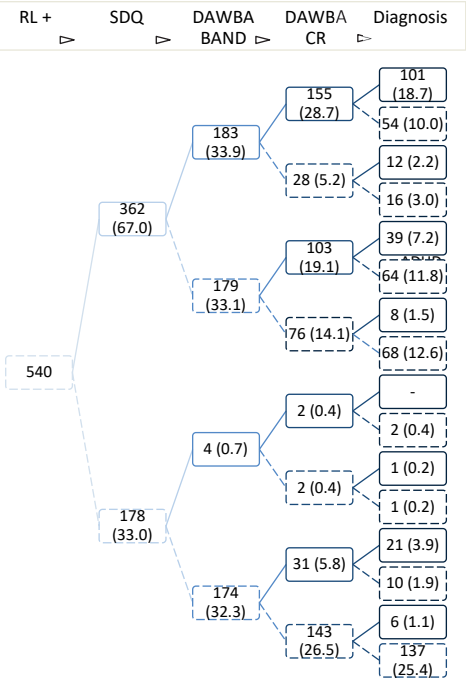


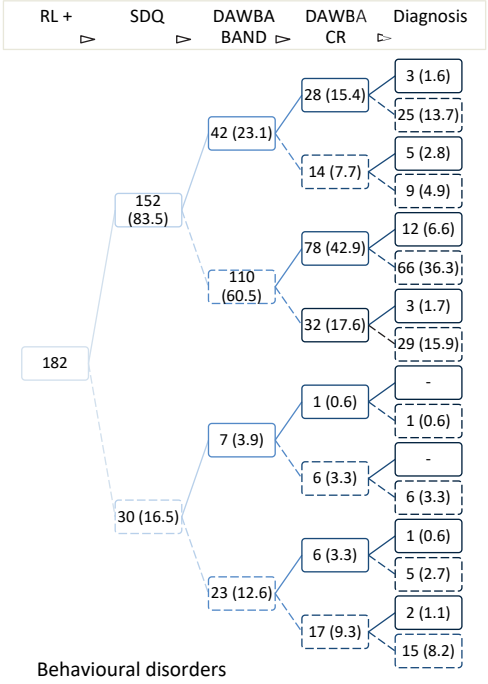


Autism Spectrum Disorders



ADHD





Behavioural disorders