Supplemental Tables for Empathy Measurement in Autistic and Non-autistic Adults: A COSMIN Systematic Literature Review

These tables present the characteristics of the included samples and the pooled measurement property estimates per sample, per measurement property, per measure.

Table S1

Information Sources and Dates of Coverage

Database	Dates of coverage
Academic Search Ultimate	1911 – present
The Education Resources Information Center	1966 – present
Health Source: Nursing/Academic Edition	1958 – present
Psychological and Behavioral Sciences Collection	1945 – present
PsycINFO	1967 – present
PsycTESTS	1967 – present

Table S2

Database Search Strings

Search #	Search phrase
Search 1	AB empath*
Search 2	Subject terms/Thesaurus (empathy OR empathy evaluation OR empathy testing)
Search 3	Search 1 OR Search 2
Search 4	AB adult*
Search 5	AB test* OR measure* OR scale* OR questionnaire* OR inventor* OR survey* OR instrument* OR assessment* OR self-report* OR patient report
Search 6	Subject terms/Thesaurus (test battery OR test construction OR test construction evaluation OR test design & construction OR test methods OR test preparation OR measurement OR measurement instruments (1966-1980) OR measuring instruments OR scales OR scale evaluation OR questionnaire design OR questionnaires evaluation OR questionnaires OR inventories OR inventory OR surveys OR instrument OR instrument construction OR instrument construction evaluation OR self-report OR self-report inventories)
Search 7	Search 5 OR Search 6
Search 8	Search 3 AND Search 4 AND Search 7

Note. Not all listed Subject/Thesaurus terms from Searches 2 & 6 were available in every database. All available terms were selected from each database.

Table S3

Sample Characteristics per Population per Measure

Measure	Reference	Group	N	Age mean (SD)	Gender (% F)	Country
Empathy Quotient						
Autistic	Baron-Cohen & Wheelwright (2004)	Study 1, Autistic adults	90	34.2 (12.5)	27.8%	UK
	Baron-Cohen et al. (2003)	Study 2, Autistic adults	47	38.1 (13.3)	29.8%	UK
	Baron-Cohen et al. (2015)	Autistic adults	395	39.9 (11.7)	54.9%	UK
	Cunningham et al. (2016)	Group 1: Relationship Enhancement Condition – Pre-existing diagnosis of mild autism or Asperger's Syndrome	19	18+	26.3%	USA
		Group 2: Relationship Enhancement ASD Condition – Pre-existing diagnosis of mild autism or Asperger's Syndrome	19	18+	15.8%	USA
	Levin et al. (2015)	Autistic university students	15	23.9 (4.6)	13.3%	USA
	Mansour (2012)	Adults diagnosed with Asperger's	32	18+	15.6%	USA
	Wheelwright et al. (2006)	Autistic adults	125	37.6 (13.1)	44.8%	-

Table S3

Sample Characteristics per Population per Measure

Measure	Reference	Group	N	Age mean (SD)	Gender (% F)	Country
PNT	Baldner and McGinley (2014)	University Students	497	19.6	67.2%	USA
	Baron-Cohen and Wheelwright (2004)	Study 1, Age- & Sex-matched PNTs	90	34.2 (11.8)	27.8%	UK
		Study 2, Male supermarket staff	71	38.8 (13.7)	0%	UK
		Study 2, Female supermarket staff	126	39.5 (12.8)	100%	UK
	Baron-Cohen et al. (2003)	Study 1, General public	103	41.3 (12.7)	-	UK, Canada
		Study 1, University students	174	20.5 (6.5)	-	UK
		Study 2, PNTs matched for age, sex, handedness, with similar SES	47	36.5 (13.2)	31.9%	UK
	Baron-Cohen et al. (2015)	PNTs with no first-degree autistic relatives	320	38.4 (11.7)	52.5%	UK
	Calvi (2009)	University students	224	19.8 (2.9)	71%	USA
	Lawrence et al. (2004)	Study 1: General Public	53	32.5 (10.9)	52.8%	UK
		Study 2: General Public & those with depersonalisation symptoms	172	45.6 (11.6)	54.1%	UK
		Study 3: General Public	29	32.0 (9.5)	62.1%	UK

Table S3

Sample Characteristics per Population per Measure

Measure	Reference	Group	N	Age mean (SD)	Gender (% F)	Country
	Levin et al. (2015)	PNT university students	-	-	-	USA
	Mansour (2012)	PNT adults who know a participant from the Asperger's group	32	18+	87.5%	USA
	Muncer and Ling (2006)	University students	362	26.3 (11.3)	53.0%	UK
	Wheelwright et al. (2006)	University students	1,761	21.0 (2.6)	58.9%	-
60-item Empathy Quotient – 2 subscales						
Autistic	Mathersul et al. (2013)	"High-functioning" autistic adults	40	37.2 (16.2)	29.0%	Australia
PNT	Mathersul et al. (2013)	PNT adults	37	41.7 (17.2)	37.5%	Australia
40-item Empathy Quotient						
Autistic	Allison et al. (2011)	Autistic adults	658	30.4 (11.4)[a]	60.7%[a]	Online database
	Sucksmith et al.(2013)	Autistic adults	329	35.5 (11.0)	51.1%	Online database
PNT	Allison et al. (2011)	Family members of an autistic individual	1,375	30.4 (11.4)[a]	60.7%[a]	Online database
		PNTs – self-selected	3,344	30.4 (11.4)[a]	60.7%[a]	Online database
	Byrd-Craven et al. (2015)	University students	233	-	36.1%	USA

Table S3

Sample Characteristics per Population per Measure

Measure	Reference	Group	N	Age mean (SD)	Gender (% F)	Country
	Muncer and Ling (2006)	University students	362	26.3 (11.3)	53.0%	UK
	Sucksmith et al. (2013)	Parents of autistic children	310	41.0 (6.3)	87.7%	Online database
		PNT adults	187	34.3 (10.8)	50.3%	Online database
28-item Empathy Quotient – 1 factor						
Autistic	-	-	-	-	-	-
PNT	Muncer and Ling (2006)	University students	362	26.3 (11.3)	53.0%	UK
28-item Empathy Quotient – 3 factors						
Autistic	-	-	-	-	-	-
PNT	Lawrence et al. (2004)	Study 1: General Public	53	32.5 (10.9)	52.8%	UK
		Study 2: General Public & those with depersonalisation symptoms	172	-	54.1%	UK
		Study 3: General Public	29	32.0 (9.5)	62.1%	UK
26-item Empathy Quotient						

Table S3

Sample Characteristics per Population per Measure

Measure	Reference	Group	N	Age mean (SD)	Gender (% F)	Country
Autistic	Allison et al. (2011)	Autistic adults	658	30.4 (11.4)[a]	60.7%[a]	Online database
PNT	Allison et al. (2011)	Self-selected family members of autistic adults	1,375	30.4 (11.4)[a]	60.7%[a]	Online database
		Self-selected community members	3,344	30.4 (11.4)[a]	60.7%[a]	Online database
23-item Empathy Quotient						
Autistic	-	-	-	-	-	-
PNT	Muncer and Ling (2006)	University students	362	26.3 (11.3)	53.0%	UK
22-item Empathy Quotient – Post hoc, 3 factors						
Autistic	-	-	-	-	-	-
PNT	Muncer and Ling (2006)	University students	362	26.3 (11.3)	53.0%	UK
	Wakabayashi et al. (2006)	University students	1,761	21.0 (2.6)	58.9%	UK
22-item Empathy Quotient						

Table S3

Sample Characteristics per Population per Measure

Measure	Reference	Group	N	Age mean (SD)	Gender (% F)	Country
Autistic	-	-	-	-	-	-
PNT	Webb et al. (2016)	University students	347	-	78%	USA
15-item Empathy Quotient						
Autistic	-	-	-	-	-	-
PNT	Muncer and Ling (2006)	University students	362	26.3 (11.3)	53.0%	UK
	Swickert et al. (2016)	University students	94	20.7 (2.5)	-	USA
		Older adults	62	74.8 (7.2)	-	USA
	Williams et al. (2016)	Community adults	278	32.6	68%	Online
Interpersonal Reactivity Index						
Autistic	Mathersul et al. (2013)	“High-functioning” autistic adults	40	37.2 (16.2)	29.0%	Australia
	Murray et al. (2017)	Autistic adults	20	30.6 (6.5)	0%	UK
	Senland and Higgins-D'Alessandro (2016)	Autistic adults	22	19.2 (2.3)	13.6%	USA

Table S3

Sample Characteristics per Population per Measure

Measure	Reference	Group	N	Age mean (SD)	Gender (% F)	Country
PNT	Baldner and McGinley (2014)	University Students	497	19.6	67.2%	USA
	Calvi (2009)	University students	224	19.8 (2.9)	71%	USA
	Davis (1980)	Step 1: University students	452	-	55.5%	USA
		Step 2: University students	427	-	48.2%	USA
		Step 3: University students	1,161	-	50.1%	USA
		Step 4: University students	109	-	48.6%	USA
	Davis (1983)	University Students	1,344	-	49.6%	USA
	Graham (2017)	Study 1, Working adults	478	-	61.9%	USA
		Study 2, Working adults	659	-	69.5%	USA
	Lyons et al. (2017)	Community sample	226	26.5 (8.8)	68.9%	Online
	Mathersul et al. (2013)	PNT adults	37	41.7 (17.2)	37.5%	Australia
	McGinley (2018)	University students	187	18.8 (1.0)	49%	USA
	Murray et al. (2017)	PNT adults matched for age, gender, and verbal ability	20	30.7 (6.27)	5.3%	UK
	Schaffer et al. (2009)	University students	244	20.7	71.3%	USA

Table S3

Sample Characteristics per Population per Measure

Measure	Reference	Group	N	Age mean (SD)	Gender (% F)	Country
	Senland and Higgins-D'Alessandro (2016)	PNT adults matched on sex and education	22	19.3 (1.0)	13.6%	USA
	Spinella (2005)	Community adults	188	26.6 (10.2)	56.9%	USA
	Thoresen (2008)	Mother-daughter dyads	144	Mothers – 61.0 (8.9) Daughters – 35.0 (8.3)	100%	USA
	Unger and Thumuluri (1997)	Community adults	405	-	56%	USA
Brief Interpersonal Reactivity Index						
Autistic	-	-	-	-	-	-
PNT	Ingoglia et al. (2016)	Adolescents & Adults	1,104	17.6 (3.0)	62%	Italy
		Adolescents & Adults	836	20.5 (3.3)	52%	Italy
		Adolescents & Adults	649	22.3 (2.4)	60%	Italy

Table S3

Sample Characteristics per Population per Measure

Measure	Reference	Group	N	Age mean (SD)	Gender (% F)	Country
Basic Empathy Scale						
Autistic	-	-	-	-	-	-
PNT	Baldner and McGinley (2014)	University Students	497	19.6	67.2%	USA
	Eckland et al. (2017)	University students	94	19.3 (1.1)	68.4%	USA
	Sebastian et al. (2012)	Community Adults	15	28.9 (4.5)	0%	UK
Hogan Empathy Scale						
Autistic	-	-	-	-	-	-
PNT	Froman and Peloquin (2001)	Occupational Therapy Students	320	26.8 (7.2)	59%	USA
	Hogan (1969)	Various PNT Samples	121	-	-	USA
	May and Alligood (2000)	Older adults	43	-	86.0%	USA
Toronto Empathy Questionnaire						
Autistic	-	-	-	-	-	-

Table S3

Sample Characteristics per Population per Measure

Measure	Reference	Group	N	Age mean (SD)	Gender (% F)	Country
PNT	Baldner and McGinley (2014)	University Students	497	19.6	67.2%	USA
	Moore et al. (2017)	Older adults	26	77.0	77.4%	USA
	Spreng et al. (2009)	Study 1: University Students	200	18.8 (1.2)	50%	Canada
		Study 2: University Students	79	18.9 (3.0)	69.6%	Canada
		Study 3: University Students	65	18.6 (2.3)	70.8%	Canada
Empathy Components Questionnaire						
Autistic	-	-	-	-	-	-
PNT	Batchelder et al. (2017)	Study 1, University students and staff	101	20.3 (1.9)	65.3%	UK
		Study 2, University and general community	211	27.8 (8.8)	55%	UK
PESE/PSSE						
Autistic	-	-	-	-	-	-
PNT	Di Giunta et al. (2010)	Study 1 – College students (combined)	1,007	21.5 (20.7)	53.1%	International

Table S3

Sample Characteristics per Population per Measure

Measure	Reference	Group	N	Age mean (SD)	Gender (% F)	Country
		US subsample-	322			
		Italian subsample –	374			
		Bolivian subsample -	311			
QCAE						
Autistic	-	-	-	-	-	-
PNT	Reniers et al. (2011)	Study 1, University students and staff	640	23.7 (7.8)	67.8%	UK
Just Leader						
Autistic	-	-	-	-	-	-
PNT	Graham (2017)	Study 1, Working adults	478	-	61.9%	USA
		Study 2, Working adults	659	-	69.5%	USA
		Study 2, Boss/direct report dyads	318	-	64.5%	USA

Note. PNT = Predominant neurotype (i.e. not autistic). PESE = Perceived Empathic Self-Efficacy Scale. PSSE = Perceived Social Self-Efficacy Scale. QCAE = The Questionnaire of Cognitive and Affective Empathy.

Table S4

Content Validity – Summarized Results in PNT Samples[a]

	Relevance	Comprehensiveness	Comprehensibility	Total rating	Quality of pooled evidence
Empathy Quotient	Indeterminate	Inconsistent	Indeterminate	Indeterminate	Low
22-item Empathy Quotient[b]	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Very Low
Interpersonal Reactivity Index	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Very Low
Brief Interpersonal Reactivity Index	Indeterminate	Sufficient	Indeterminate	Indeterminate	Moderate
Basic Empathy Scale	-	-	-	-	-
Hogan Empathy Scale	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Very Low
Toronto Empathy Questionnaire	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Low
Empathy Components Questionnaire	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Very Low
PESE/PSSE	-	-	-	-	-
QCAE	-	-	-	-	-
Just Leader	Indeterminate	Indeterminate	Indeterminate	Indeterminate	Low

Note. PNT = Predominant neurotype (i.e. not autistic). PESE = Perceived Empathic Self-Efficacy Scale. PSSE = Perceived Social Self-Efficacy Scale. QCAE = The Questionnaire of Cognitive and Affective Empathy.

[a]Content validity was not evaluated with autistic samples. [b]Content validity was not evaluated for the eight remaining EQ versions.

Table S5

Structural Validity – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Empathy Quotient			
Autistic	EQ loaded negatively onto a systemizing quotient factor	Indeterminate (100% of studies were indeterminate)	Low (risk of bias)
PNT	1-3 factors	Indeterminate (3 studies were indeterminate, 1 insufficient)	Low (risk of bias, inconsistency)
60-item Empathy Quotient – 2 subscales	-	-	-
Autistic	-	-	-
PNT	-	-	-
40-item Empathy Quotient			
Autistic	2 factors	Indeterminate (100% of studies were indeterminate)	High
PNT	2 factors	Indeterminate (100% of studies were indeterminate)	High
28-item Empathy Quotient – 1 factor			

Table S5

Structural Validity – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Autistic	-	-	-
PNT	1 factor	Insufficient (100% of studies were insufficient)	Moderate (risk of bias)
28-item Empathy Quotient – 3 factors			
Autistic	-	-	-
PNT	3 factors	Sufficient (100% of studies were sufficient)	Moderate (risk of bias)
26-item Empathy Quotient			
Autistic	2 factors	Sufficient (100% of studies were sufficient)	Moderate (risk of bias)
PNT	2 factors	Sufficient (100% of studies were sufficient)	Moderate (risk of bias)
23-item Empathy Quotient			
Autistic	-	-	-

Table S5

Structural Validity – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
PNT	3 factors	Sufficient (100% of studies were sufficient)	Moderate (risk of bias)
22-item Empathy Quotient – Post hoc, 3 factors			
Autistic	-	-	-
PNT	3 factors	Sufficient (100% of studies were sufficient)	Moderate (risk of bias)
22-item Empathy Quotient			
Autistic	-	-	-
PNT	3 factors	Sufficient (100% of studies were sufficient)	Moderate (risk of bias)
15-item Empathy Quotient			
Autistic	-	-	-

Table S5

Structural Validity – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
PNT	3 factors	Sufficient (100% of studies were sufficient)	Moderate (risk of bias)
Interpersonal Reactivity Index			
Autistic	-	-	-
PNT	4 factors	Indeterminate (100% of studies were indeterminate)	High
Brief Interpersonal Reactivity Index – results combined with adolescents			
Autistic	-	-	-
PNT	4 factors	Sufficient	Moderate (indirectness)
Basic Empathy Scale			
Autistic	-	-	-

Table S5

Structural Validity – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
PNT	Loaded with other empathy measures	Indeterminate (100% of studies were indeterminate)	Low (risk of bias, indirectness – evaluated structural validity with other measures)
Hogan Empathy Scale			
Autistic	-	-	-
PNT	3-16 factors	Indeterminate (100% of studies were indeterminate)	Moderate (risk of bias)
Toronto Empathy Questionnaire			
Autistic	-	-	-
PNT	Unidimensional	Indeterminate (100% of studies were indeterminate)	Moderate (risk of bias)
Empathy Components Questionnaire			
Autistic	-	-	-

Table S5

Structural Validity – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
PNT	5 factors	Insufficient (1 study indeterminate, 1 study insufficient)	High
PESE/PSSE			
Autistic	-	-	-
PNT	2 factors	Insufficient (100% of studies were insufficient)	High
QCAE			
Autistic	-	-	-
PNT	2 factors	Insufficient (100% of studies were insufficient)	High
Just Leader			
Autistic	-	-	-

Table S5

Structural Validity – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
PNT	Empathy scale unidimensional	Insufficient (1 study indeterminate, 1 study insufficient)	Moderate (indirectness – results reports for whole measure, not just empathy scale)

Note. PNT = Predominant neurotype (i.e. not autistic). PESE = Perceived Empathic Self-Efficacy Scale. PSSE = Perceived Social Self-Efficacy Scale. QCAE = The Questionnaire of Cognitive and Affective Empathy.

Table S6

Internal Consistency – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Empathy Quotient			
Autistic	Cronbach's alpha = .77 - .92	Indeterminate (100% of studies were indeterminate)	Moderate (inconsistency)
PNT	Cronbach's alpha = .84 - .92	Indeterminate (100% of studies were indeterminate)	High
60-item Empathy Quotient – 2 subscales			
Autistic	-	-	-
PNT	-	-	-
40-item Empathy Quotient			
Autistic	Cronbach's alpha = .99	Indeterminate (100% of studies were indeterminate)	High
PNT	Item reliability = .89 - .99	Indeterminate (100% of studies were indeterminate)	High
28-item Empathy Quotient – 1 factor			

Table S6

Internal Consistency – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Autistic	-	-	-
PNT	Cronbach's alpha = .85	Indeterminate (100% of studies were indeterminate)	High
28-item Empathy Quotient – 3 factors			
Autistic	-	-	-
PNT	-	-	-
26-item Empathy Quotient			
Autistic	Item reliability = .99	Indeterminate (100% of studies were indeterminate)	Low (risk of bias)
PNT	Item reliability = .99	Indeterminate (100% of studies were indeterminate)	Low (risk of bias)
23-item Empathy Quotient			
Autistic	-	-	-

Table S6

Internal Consistency – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
PNT	-	-	-
22-item Empathy Quotient – Post hoc, 3 factors			
Autistic	-	-	-
PNT	-	-	-
22-item Empathy Quotient			
Autistic	-	-	-
PNT	Cronbach's alpha = .81 – .90	Indeterminate (100% of studies were indeterminate)	High
15-item Empathy Quotient			
Autistic	-	-	-
PNT	Cronbach's alpha = .67	Indeterminate (100% of studies were indeterminate)	High

Table S6

Internal Consistency – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Interpersonal Reactivity Index			
Autistic	Cronbach's alpha = .64 - .84	Indeterminate (100% of studies were indeterminate)	Low (pooled sample < 50)
PNT	Cronbach's alpha = .64 - .86	Indeterminate (100% of studies were indeterminate)	Moderate (inconsistency)
Brief Interpersonal Reactivity Index			
Autistic	-	-	-
PNT	Cronbach's alpha for subscales = .38-.82	Insufficient (100% of studies were insufficient)	Very Low (inconsistency, indirectness)
Basic Empathy Scale			
Autistic	-	-	-
PNT	Cronbach's alpha = .69 - .86	Indeterminate (100% of studies were indeterminate)	Moderate (inconsistency)
Hogan Empathy Scale			

Table S6

Internal Consistency – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Autistic	-	-	-
PNT	Cronbach's alpha = .57	Indeterminate (100% of studies were indeterminate)	High
Toronto Empathy Questionnaire			
Autistic	-	-	-
PNT	Cronbach's alpha = .85 - .88	Indeterminate (100% of studies were indeterminate)	High
Empathy Components Questionnaire			
Autistic	-	-	-
PNT	Cronbach's alpha = .70 - .81	Indeterminate (100% of studies were indeterminate)	High
PESE/PSSE			
Autistic	-	-	-

Table S6

Internal Consistency – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
PNT	Cronbach's alpha = .80	Indeterminate (100% of studies were indeterminate)	High
QCAE			
Autistic	-	-	-
PNT	Cronbach's alpha = .65 - .85	Indeterminate (100% of studies were indeterminate)	High
Just Leader			
Autistic	-	-	-
PNT	Cronbach's alpha = .75	Indeterminate (100% of studies were indeterminate)	Moderate (indirectness – results reported for whole measure, not just empathy scale)

Note. PNT = Predominant neurotype (i.e. not autistic). PESE = Perceived Empathic Self-Efficacy Scale. PSSE = Perceived Social Self-Efficacy Scale. QCAE = The Questionnaire of Cognitive and Affective Empathy.

Table S7

Measurement Invariance – Summarized Result in PNT samples[a]

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Empathy Quotient	Factor structure varied by group (control vs. clinical)	Insufficient (100% of studies were insufficient)	Very low (risk of bias)
26-item Empathy Quotient[b]	Measurement invariance demonstrated	Sufficient	Low (risk of bias)
Interpersonal Reactivity Index	Factor structure remains consistent across gender	Sufficient	High
Brief Interpersonal Reactivity Index	-	-	-
Basic Empathy Scale	-	-	-
Hogan Empathy Scale	-	-	-
Toronto Empathy Questionnaire	Factor structure varied by gender	Indeterminate (1 study indeterminate, 1 study insufficient)	Moderate (risk of bias)
Empathy Components Questionnaire	-	-	-
PESE/PSSE	Factor structure remains consistent across gender	Sufficient	Low
QCAE	-	-	-

Table S7

Measurement Invariance – Summarized Result in PNT samples[a]

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Just Leader	-	-	-

Note. PNT = Predominant neurotype (i.e. not autistic). PESE = Perceived Empathic Self-Efficacy Scale. PSSE = Perceived Social Self-Efficacy Scale. QCAE = The Questionnaire of Cognitive and Affective Empathy.

[a]Measurement invariance was not evaluated with autistic samples. [b]Measurement invariance was not evaluated for the remaining eight versions of the EQ.

Table S8

Reliability – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Empathy Quotient[a]			
Autistic	Test-retest reliability, *r* = .97	Indeterminate (100% of studies were indeterminate)	Very low (risk of bias and pooled sample <100)
PNT	Test-retest reliability, *r* = .84 - .97	Indeterminate (100% of studies were indeterminate)	Moderate (risk of bias)
Interpersonal Reactivity Index			
Autistic	-	-	-
PNT	Test-retest reliability, *r* = .61 - .81	Indeterminate (100% of studies were indeterminate)	Low (risk of bias)
Brief Interpersonal Reactivity Index			
Autistic	-	-	-
PNT	-	-	-
Basic Empathy Scale			
Autistic	-	-	-

Table S8

Reliability – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
PNT	-	-	-
Hogan Empathy Scale			
Autistic	-	-	-
PNT	Test-retest reliability, r = .30 - .84	Indeterminate (100% of studies were indeterminate)	Very Low (risk of bias, inconsistency)
Toronto Empathy Questionnaire			
Autistic	-	-	-
PNT	-	-	-
Empathy Components Questionnaire			
Autistic	-	-	-
PNT	-	-	-
PESE/PSSE			
Autistic	-	-	-

Table S8

Reliability – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
PNT	-	-	-
Just Leader			
Autistic	-	-	-
PNT	-	-	-

Note. PNT = Predominant neurotype (i.e. not autistic). PESE = Perceived Empathic Self-Efficacy Scale. PSSE = Perceived Social Self-Efficacy Scale. QCAE = The Questionnaire of Cognitive and Affective Empathy.

[a]Reliability was not evaluated for the remaining nine versions of the EQ.

Table S9

Criterion Validity – Summarized Results in PNT samples[a]

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Empathy Quotient[b]	Correlation with Eyes Test not significant to low. Correlation with IRI subscales not significant to r = .63 (below .70 cut-off)	Insufficient (100% of studies were insufficient)	High
Interpersonal Reactivity Index	Correlation with EQ subscales r = .40 - .80 (mostly below .70 cut-off)	Insufficient (most studies were insufficient)	Moderate (risk of bias)
Brief Interpersonal Reactivity Index	-	-	-
Basic Empathy Scale	-	-	-
Hogan Empathy Scale	-	-	-
Toronto Empathy Questionnaire	Correlation with IRI-EC, r = .71-.74, with IRI-PT, r = .29-.35	Inconsistent	High
Empathy Components Questionnaire	-	-	-
PESE/PSSE	-	-	-

Table S9

Criterion Validity – Summarized Results in PNT samples[a]

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
QCAE	Cognitive scale correlated with BES at *r* = .76, affective scale correlated with BES at *r* = .62	Inconsistent	High
Just Leader	Positive empathy subscale correlated with IRI at *r* = .35-.61	Insufficient	High

Note. PNT = Predominant neurotype (i.e. not autistic). PESE = Perceived Empathic Self-Efficacy Scale. PSSE = Perceived Social Self-Efficacy Scale. QCAE = The Questionnaire of Cognitive and Affective Empathy.

[a]Criterion validity was not evaluated with autistic samples. [b]Criterion validity was not evaluated for the remaining nine versions of the EQ.

Table S10

Construct Validity (hypotheses testing) – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Empathy Quotient			
Autistic	Results in accordance with hypothesized group differences and relationships with other measures in most studies.	Sufficient (5/6 studies sufficient)	Moderate (risk of bias)
PNT	Results inconsistent.	Inconsistent	Low (inconsistency)
60-item Empathy Quotient – 2 subscales			
Autistic	Less than 75% of results in accordance with hypotheses.	Insufficient (100% of studies were insufficient)	Very Low (risk of bias and pooled sample < 50)
PNT	Results not consistent with hypotheses.	Insufficient	Very Low (risk of bias, imprecision)
40-item Empathy Quotient			
Autistic	Most results in accordance with hypotheses.	Sufficient (1 study sufficient, 1 indeterminate)	Moderate (risk of bias)

Table S10

Construct Validity (hypotheses testing) – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
PNT	Results mostly in accordance with hypotheses.	Sufficient	Moderate (risk of bias)
28-item Empathy Quotient – 1 factor			
Autistic	-	-	-
PNT	-	-	-
28-item Empathy Quotient – 3 factors			
Autistic	-	-	-
PNT	-	-	-
26-item Empathy Quotient			
Autistic	-	-	-
PNT	-	-	-
23-item Empathy Quotient			
Autistic	-	-	-

Table S10

Construct Validity (hypotheses testing) – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
PNT	-	-	-
22-item Empathy Quotient – Post hoc, 3 factors			
Autistic	-	-	-
PNT	-	-	-
22-item Empathy Quotient			
Autistic	-	-	-
PNT	Results in accordance with hypotheses.	Sufficient	High
15-item Empathy Quotient			
Autistic	-	-	-
PNT	Results inconsistent	Inconsistent	High
Interpersonal Reactivity Index			

Table S10

Construct Validity (hypotheses testing) – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Autistic	Results mostly consistent with hypothesized group differences.	Inconsistent	Low (risk of bias, pooled sample < 100)
PNT	Results inconsistent	Inconsistent	Low (inconsistency)
Brief Interpersonal Reactivity Index			
Autistic	-	-	-
PNT	Results consistent with hypotheses.	Sufficient	Moderate (indirectness)
Basic Empathy Scale			
Autistic	-	-	-
PNT	Results inconsistent	Inconsistent	Low (inconsistency)
Hogan Empathy Scale			
Autistic	-	-	-
PNT	Results inconsistent	Inconsistent	Moderate (inconsistency)
Toronto Empathy Questionnaire			

Table S10

Construct Validity (hypotheses testing) – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Autistic	-	-	-
PNT	Results inconsistent	Inconsistent	Moderate (risk of bias)
Empathy Components Questionnaire			
Autistic	-	-	-
PNT	Results consistent with hypothesised sex differences and empathy models	Sufficient (100% of studies were sufficient)	High
PESE/PSSE			
Autistic	-	-	-
PNT	-	-	-
QCAE			
Autistic	-	-	-
PNT	Results consistent with hypothesised relationships with other empathy measures	Sufficient	Very Low (extremely serious risk of bias)

Table S10

Construct Validity (hypotheses testing) – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Just Leader			
Autistic	-	-	-
PNT	Results consistent with hypothesised sex differences	Sufficient	High

Note. PNT = Predominant neurotype (i.e. not autistic). PESE = Perceived Empathic Self-Efficacy Scale. PSSE = Perceived Social Self-Efficacy Scale. QCAE = The Questionnaire of Cognitive and Affective Empathy.

Table S11

Responsiveness – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Empathy Quotient[a]	-	-	-
Autistic	Scores did not change in the expected direction after the empathy intervention.	Insufficient (100% of studies were insufficient)	Low (pooled sample < 50)
PNT			
Interpersonal Reactivity Index			
Autistic	-	-	-
PNT	-	-	-
Brief Interpersonal Reactivity Index			
Autistic	-	-	-
PNT	-	-	-
Basic Empathy Scale			
Autistic	-	-	-
PNT	-	-	-

Table S11

Responsiveness – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
Hogan Empathy Scale			
Autistic	-	-	-
PNT	-	-	-
Toronto Empathy Questionnaire			
Autistic	-	-	-
PNT	Scores did not change in the expected direction after the empathy intervention.	Insufficient (100% of studies were insufficient)	Low (pooled sample < 50)
Empathy Components Questionnaire			
Autistic	-	-	-
PNT	-	-	-
PESE/PSSE			
Autistic	-	-	-
PNT	-	-	-

Table S11

Responsiveness – Summarized Results

	Summarised result	Overall rating	Quality of pooled evidence (reason for downgrade)
QCAE			
Autistic	-	-	-
PNT	-	-	-
Just Leader			
Autistic	-	-	-
PNT	-	-	-

Note. PNT = Predominant neurotype (i.e. not autistic). PESE = Perceived Empathic Self-Efficacy Scale. PSSE = Perceived Social Self-Efficacy Scale. QCAE = The Questionnaire of Cognitive and Affective Empathy.

[a]Responsiveness was not assessed in the remaining nine EQ versions.

Table S12

Empathy Quotient Measurement Property Ratings with Autistic Samples – Separated by Study

Study	Structural validity			Internal consistency			Reliability			Construct validity			Responsiveness		
	N	Rating	Bias[a]	N	Rating	Bias	N	Rating	Bias	N	Rating	Bias	N	Rating	Bias
Empathy Quotient															
Baron-Cohen & Wheelwright, 2004	-	-	-	90	?	Very Good	90	?	Doubtful	90	Sufficient	Inadequate	-	-	-
Baron-Cohen et al., 2003	-	-	-	-	-	-	-	-	-	47	Sufficient	Doubtful	-	-	-
Baron-Cohen et al., 2015	-	-	-	-	-	-	-	-	-	395	Sufficient	Inadequate	-	-	-
Cunningham et al., 2016	-	-	-	38	?	Very Good	-	-	-	-	-	-	38	Insufficient	Very Good
Levin et al., 2015	-	-	-	-	-	-	-	-	-	15	Insufficient	Inadequate	-	-	-

Table S12

Empathy Quotient Measurement Property Ratings with Autistic Samples – Separated by Study

Study	Structural validity			Internal consistency			Reliability			Construct validity			Responsiveness		
	N	Rating	Bias[a]	N	Rating	Bias	N	Rating	Bias	N	Rating	Bias	N	Rating	Bias
Mansour, 2012	-	-	-	32	?	Very Good	-	-	-	32	Sufficient	Doubtful	-	-	-
Wheelwright et al., 2006	125	?	Doubtful	-	-	-	-	-	-	125	Sufficient	Doubtful	-	-	-
60-item EQ – 2 subscales															
Mathersul et al., 2013	-	-	-	-	-	-	-	-	-	40	Insufficient	Doubtful	-	-	-
40-item EQ															
Allison et al., 2011	658	?	Very Good	658	?	Very Good	-	-	-	658	Sufficient	Doubtful	-	-	-
Sucksmith et al., 2013	-	-	-	-	-	-	-	-	-	329	Sufficient	Doubtful	-	-	-
26-item EQ															
Allison et al.,	658	Sufficient	Adequate	658	Sufficient	Doubtful	-	-	-	-	-	-	-	-	-

Table S12

Empathy Quotient Measurement Property Ratings with Autistic Samples – Separated by Study

Study	Structural validity			Internal consistency			Reliability			Construct validity			Responsiveness		
	N	Rating	Bias[a]	N	Rating	Bias	N	Rating	Bias	N	Rating	Bias	N	Rating	Bias
2011															

Notes. EQ = Empathy Quotient. ? = indeterminate rating where not enough information was available to determine the sufficiency of the measurement property. - = indicates a field for which there were not data available.

[a] Refers to ratings from the COSMIN Risk of Bias Checklist, where “Very Good” refers to a study with a low risk of bias and “Inadequate” refers to a study with a high risk of bias (Mokkink et al., 2018).

Table 13

Interpersonal Reactivity Index Measurement Property Ratings with Autistic Samples – Separated by Study

	Structural Validity			Internal Consistency			Reliability			Construct Validity			Responsiveness		
Study	N	Rating	Bias[a]	N	Rating	Bias	N	Rating	Bias	N	Rating	Bias	N	Rating	Bias
Mathersul et al., 2013	-	-	-	-	-	-	-	-	-	40	Sufficient	Doubtful	-	-	-
Murray et al., 2017	-	-	-	-	-	-	-	-	-	20	Insufficient	Inadequate	-	-	-
Senland & Higgins-D'alessandro, 2016	-	-	-	22	?	Very Good	-	-	-	22	Sufficient	Doubtful	-	-	-

Notes. EQ = Empathy Quotient. ? = indeterminate rating where not enough information was available to determine the sufficiency of the measurement property. - = indicates a field for which there were not data available.

[a] Refers to ratings from the COSMIN Risk of Bias Checklist, where "Very Good" refers to a study with a low risk of bias and "Inadequate" refers to a study with a high risk of bias (Mokkink et al., 2018).

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