

Fig. S1 Study design of ASD time trend

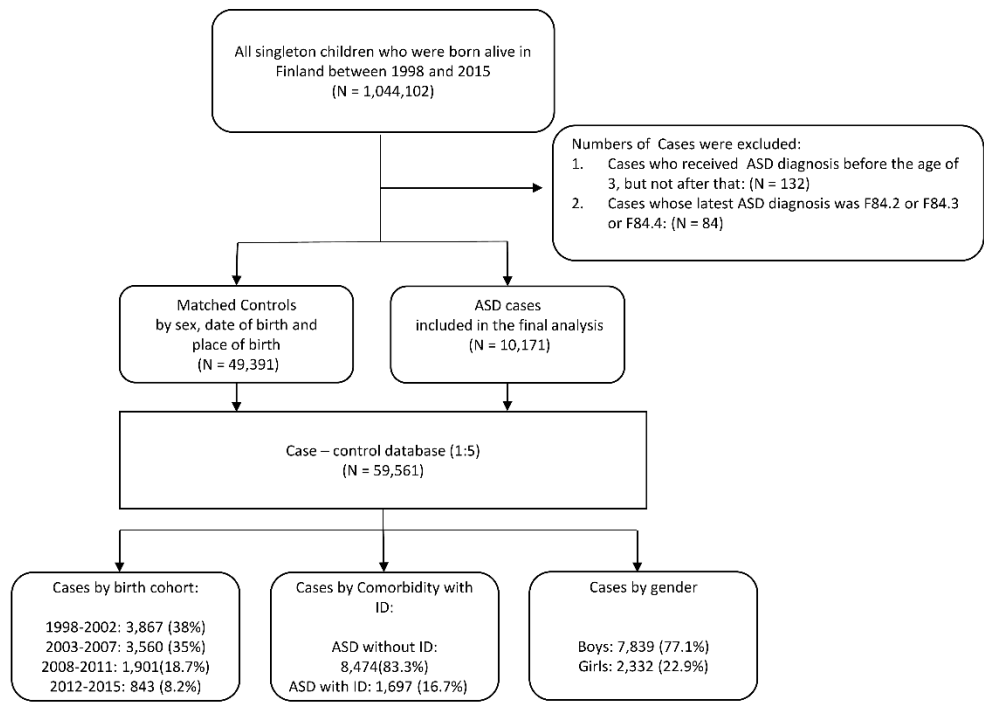


Fig. S2 Yearly incidence of ASD per 100 persons among boys and girls

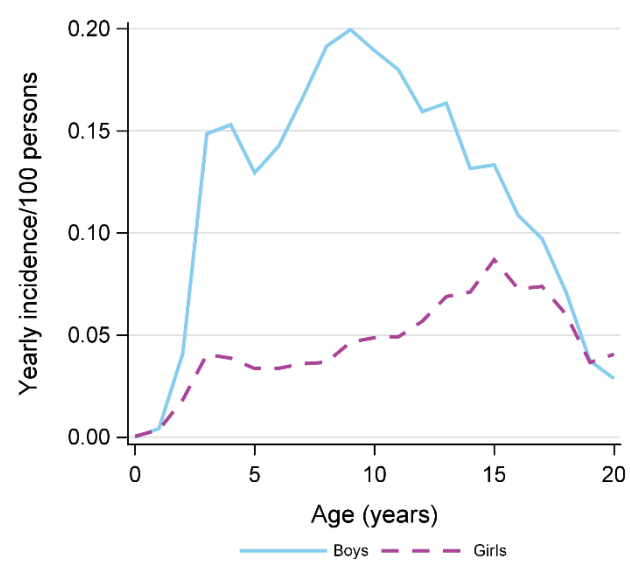


Fig. S3 Yearly incidence of ASD with and without ID per 100 persons among boys and girls

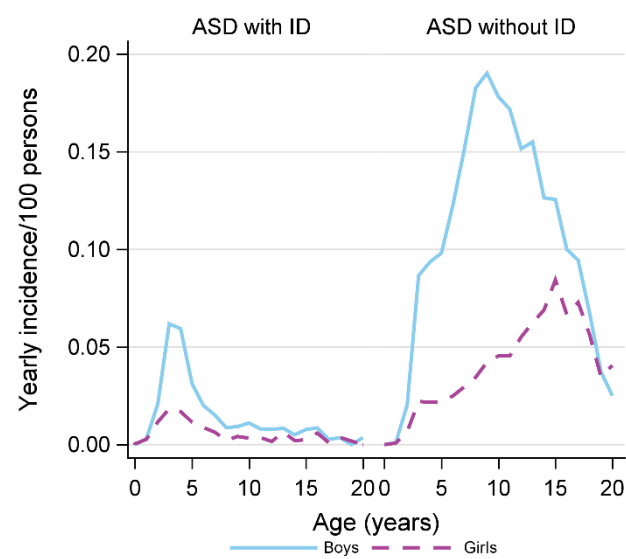


Fig. S4 Cumulative incidence of ASD with and without ID per 100 persons among boys and girls for birth cohorts

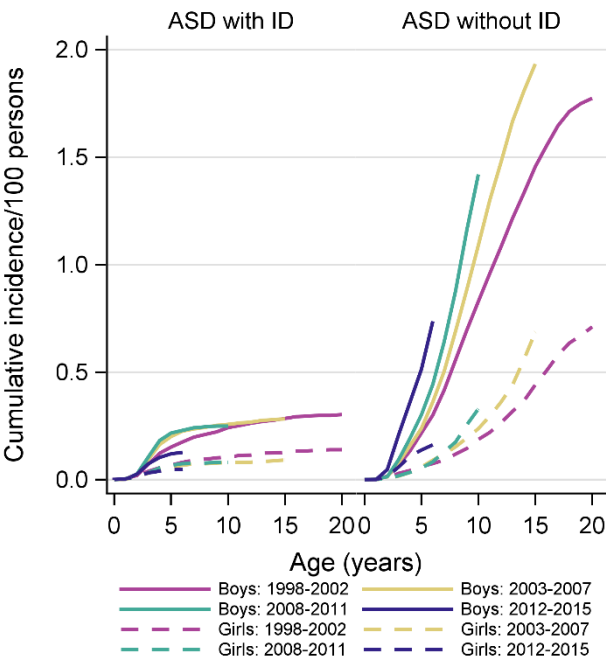


Table S1 Univariate association between sociodemographic factors in total ASD cases and controls

Sociodemographic factor		Cases (N = 10,171) n (%)	Controls (N = 49,391) n (%)	Univariate ^b OR (95%CI)
Maternal SES	Upper white-collar workers	1,514 (14.9)	83508 (16.9)	Ref
	Unknown	1,745 (17.2)	7063 (14.3)	1.38 (1.28 – 1.49) ***
	Lower white-collar workers	3,254 (31.9)	17884 (36.2)	1.01 (0.94–1.08)
	Blue-collar workers	1,566	7294 (14.8)	1.20 (1.11–1.30) ***
	Others ^a	2,092	8800 (17.8)	1.34 (1.25–1.44) ***
Birth region	Southern Finland	4,400 (43.3)	20505 (41.5)	Ref
	Western Finland	3,414 (33.6)	17384 (35.2)	0.92 (0.87–0.96) **
	Northern Finland	1,270 (12.5)	6884 (13.9)	0.86 (0.80–0.92) ***
	Eastern Finland	1,087 (10.7)	4618 (9.3)	1.10 (1.02–1.18) *
Place of birth	Urban	7,058 (69.4)	32220 (65.2)	Ref
	Semi-urban	1,474 (14.5)	8040 (16.3)	0.84 (0.79–0.89) ***
	Rural	1,577 (15.5)	8800 (17.8)	0.82 (0.78–0.87) ***
Marital status	Married/in relationship	8,634 (84.9)	43864 (88.8)	Ref
	Single	816 (80.2)	2692 (5.5)	1.54 (1.41–1.67) ***
Parental immigration status	Both parents Finnish	8,827 (86.8)	44863 (90.8)	Ref
	Mother immigrant	269 (2.6)	974 (2.0)	1.39 (1.21–1.60) ***
	Father immigrant	300 (2.9)	1260 (2.6)	1.22 (1.07–1.39) **
	Both parents immigrants	500 (4.9)	1624 (3.3)	1.60 (1.44–1.77) ***
Maternal age (years)	<20	368 (3.6)	1315 (2.7)	1.44 (1.28–1.63) ***
	20–24	1,798 (17.7)	8077 (16.4)	1.14 (1.07–1.22) ***
	25–29	3,037 (29.9)	15586 (31.6)	Ref
	30–34	2,868 (28.2)	15198 (30.8)	0.97 (0.92–1.02)
	35–39	1,602 (15.8)	7385 (15.0)	1.11 (1.04–1.19) **
	≥40	481 (4.7)	1777 (3.6)	1.38 (1.24–1.54) ***
Paternal age (years)	<20	116 (1.2)	441 (0.9)	1.40 (1.14–1.73) **
	20–24	1,033 (10.4)	4746 (9.7)	1.17 (1.08–1.27) ***
	25–29	2,400 (24.3)	12411 (25.5)	1.03 (0.98–1.10)
	30–34	2,918 (29.5)	15689 (32.2)	Ref
	35–39	2,027 (20.5)	9872 (20.3)	1.10 (1.03–1.17) **
	40–44	903 (9.1)	3903 (8)	1.25 (1.15–1.36) ***
	45–49	326 (3.3)	1214 (2.5)	1.43 (1.26–1.63) ***
	≥50	173 (1.7)	455 (0.9)	2.1 (1.71–2.46) ***

a) Students, pensioners, unemployed, small business entrepreneurs, housewives and househusbands.

b) univariate conditional logistic regression

Ref = Reference category, OR = Odds ratio, CI = Confidence Interval, SES= Socioeconomic Status

number of missing: Maternal SES: 1745 (17.2%), Urbanicity: 62 (0.6%), Marital status: 721 (7.1%), Parental immigration status: 275 (2.7%), Maternal age: 17 (0.2%), Paternal age: 275 (2.7%)

*** p <.001, ** p <.01, * p <.05

Table S2 Univariate association between sociodemographic factors in ASD with and without ID cases and controls

Sociodemographic factor		ASD without ID Univariate ^c OR (95%CI)	ASD with ID Univariate ^c OR (95%CI)
Maternal SES	Upper white-collar workers	Ref	Ref
	Unknown	1.33 (1.22–1.45) ***	1.66 (1.37–2.01) ***
	Lower white-collar workers	0.96 (0.89–1.04)	1.28 (1.08–1.53) **
	Blue-collar workers	1.12 (1.03–1.22) *	1.70 (1.40–2.08) ***
	Others ^a	1.30 (1.20–1.41) ***	1.61 (1.33–1.95) ***
Birth region	Southern Finland	Ref	Ref
	Western Finland	0.91 (0.87–0.96) **	0.92 (0.81–1.04)
	Northern Finland	0.85 (0.78–0.91) ***	0.94 (0.79–1.11)
	Eastern Finland	0.99 (0.91–1.08)	1.67 (1.41–1.96) ***
Place of birth	Urban	Ref	Ref
	Semi-urban	0.83 (0.77–0.88) ***	0.88 (0.75–1.02)
	Rural	0.78 (0.73–0.83) ***	1.01 (0.88–1.16)
Marital status	Married/in relationship	Ref	Ref
	Single	1.48 (1.35–1.62) ***	1.84 (1.51–2.24) ***
Parental immigration status	Both parents Finnish	Ref	Ref
	Mother immigrant	1.29 (1.11–1.50) **	2.01 (1.46–2.76) ***
	Father immigrant	1.17 (1.01–1.35) *	1.48 (1.10–1.99) **
	Both parents immigrants	1.34 (1.18–1.51) ***	2.69 (2.20–3.29) ***
Maternal age (years)	<20	1.48 (1.30–1.69) ***	1.22 (0.88–1.68)
	20–24	1.15 (1.07–1.23) ***	1.11 (0.94–1.30)
	25–29	Ref	Ref
	30–34	0.97 (0.91–1.03)	0.96 (0.83–1.10)
	35–39	1.09 (1.01–1.17) *	1.25 (1.07–1.47)
	≥40	1.32 (1.17–1.48) ***	1.72 (1.34–2.20) ***
Paternal age (years)	<20	1.43 (1.14–1.79) **	1.26 (0.73–2.20)
	20–24	1.15 (1.06–1.26) ***	1.25 (1.02–1.53)
	25–29	1.03 (0.96–1.10)	1.09 (0.94–1.26)
	30–34	Ref	Ref
	35–39	1.06 (0.99–1.14)	1.29 (1.11–1.51) ***
	40–44	1.16 (1.06–1.28) **	1.73 (1.43–2.10) ***
	45–49	1.37 (1.18–1.58) ***	1.80 (1.33–2.43) ***
	≥50	1.96 (1.61–2.40) ***	2.52(1.65–3.84) ***

a) Students, pensioners, unemployed, small business entrepreneurs, housewives and househusbands.

b) univariate conditional logistic regression

Ref = reference category, OR = odds ratio, CI = confidence interval, SES= socioeconomic status

*** p <.001, ** p <.01, * p <.05

Table S3 Interaction of gender and birth cohort with sociodemographic risk factors

Sociodemographic risk factors	Biological sex	Birth cohort
	p-value	p-value
Maternal SES	0.26	0.97
Region of birth	0.02	<.001
Urbanicity	0.47	0.27
Marital Status	0.57	0.80
Parental Immigration status	0.21	<.001
Maternal age	0.60	0.34
Paternal age	0.60	0.61

SES= socioeconomic status

Table S4 Region of birth and total ASD by biological sex

Biological sex		Cases	Controls	Unadjusted	Adjusted ^a
		n (%)	n (%)	OR (95% CI)	OR (95% CI)
Boys	Southern Finland	3434 (43.8)	15831 (41.6)	Ref	Ref
	Western Finland	2591 (33.1)	13389 (35.1)	0.89 (0.84-0.94) ***	0.91 (0.85-0.97) **
	Northern Finland	1008 (12.9)	5322 (14.0)	0.87 (0.81-0.94) ***	0.95 (0.88-1.04)
	Eastern Finland	806 (10.3)	3553 (9.3)	1.04 (0.96-1.14)	1.12 (1.02-1.23) *
Girls	Southern Finland	966 (41.4)	4674 (41.4)	Ref	Ref
	Western Finland	823 (35.3)	3995 (35.4)	1.0 (0.90-1.10)	0.99 (0.88-1.11)
	Northern Finland	262 (11.2)	1562 (13.8)	0.81 (0.70-0.94) **	0.81 (0.69-0.95) **
	Eastern Finland	281 (12.0)	1056 (9.4)	1.28 (1.10-1.48) **	1.30 (1.10-1.53) **

a) Adjusted with maternal SES class, region of birth, urbanicity, maternal marital status, parental immigration status, parental age

*** p <.001, ** p <.01, * p <.05

Table S5 Parental immigrant status and total ASD by birth cohort

Birth cohort	Parental immigration status	Cases (N = 9,896) ^b n (%)	Controls (N = 48,721) n (%)	Unadjusted OR (95% CI)	Adjusted ^a OR (95% CI)
1998-2002	Both parents Finnish	3,522 (93.4)	1,731 (94.0)	Ref	Ref
	Mother immigrant	85 (2.3)	298 (1.6)	1.40 (1.10-1.79) **	1.14 (0.87-1.50)
	Father immigrant	108 (2.9)	408 (2.2)	1.31 (1.05-1.63) *	1.10 (0.86-1.40)
	Both parents immigrants	57 (1.5)	401 (2.2)	0.70 (0.53-0.93) *	0.54 (0.39-0.73) ***
2003-2007	Both parents Finnish	3,203 (92.1)	15,770 (92.4)	Ref	Ref
	Mother immigrant	77 (2.2)	363 (2.1)	1.04 (0.81-1.33)	0.87 (0.67-1.13)
	Father immigrant	95 (2.7)	414 (2.4)	1.13 (0.90-1.42)	1.05 (0.82-1.34)
	Both parents immigrants	103 (3.0)	527 (3.1)	0.97 (0.78-1.21)	0.81 (0.64-1.01)
2008-2011	Both parents Finnish	1,600 (87.2)	8,211 (90)	Ref	Ref
	Mother immigrant	55 (3.0)	205 (2.2)	1.35 (1.00-1.83) *	1.18 (0.86-1.63)
	Father immigrant	63 (3.4)	286 (3.1)	1.13 (0.85-1.49)	1.08 (0.80-1.45)
	Both parents immigrants	117 (6.4)	423 (4.6)	1.43 (1.15-1.77) **	1.37 (1.09-1.72) **
2012-2015	Both parents Finnish	502 (61.9)	3,511 (86.8)	Ref	
	Mother immigrant	52 (6.4)	108 (2.7)	3.14 (2.22-4.44) ***	2.61 (1.77-3.85) ***
	Father immigrant	34 (4.2)	152 (3.8)	1.60 (1.09-2.37) *	1.53 (0.99-2.35)
	Both parents immigrants	223 (27.5)	273 (6.8)	6.12 (4.94-7.59) ***	6.67 (5.21-8.54) ***

a) Adjusted with maternal Socioeconomic status, region of birth, urbanicity, maternal marital status, parental immigration status, parental age

b) Number of missing: 275 (2.7%)

*** p <.001, ** p <.01, * p <.05

Table S6 Co-occurring with other psychiatric disorders in total ASD, ASD with and without ID in the oldest birth cohort (1998 – 2002)

	Total cases			ASD without ID			ASD with ID		
	Cases (N = 3,867)	Controls (N = 18,727)	OR (95% CI) ^a	Cases (N = 3,255)	Controls (N = 15,772)	OR (95% CI) ^a	Cases (N = 612)	Controls (N = 2,955)	OR (95% CI) ^a
	n (%)	n (%)		n (%)	n (%)		n (%)	n (%)	
ADHD	1,209 (31.3)	702 (3.7)	11.60 (10.37 – 12.99) ***	1,104(33.9)	592 (3.8)	13.08 (11.58 – 14.77) ***	105 (17.2)	110 (3.7)	5.72 (4.13 – 7.92) ***
Schizophrenia	236 (6.1)	84 (0.4)	13.96 (10.70 – 18.20) ***	204 (6.3)	67 (0.4)	15.15 (11.27 – 20.37) ***	32 (5.2)	17 (0.6)	10.57 (5.60 – 19.94) ***
Depressive disorder	856 (22.1)	917 (4.9)	5.61 (5.02 – 6.27) ***	827 (25.4)	753 (4.8)	7.14 (6.33 – 8.05) ***	29 (4.7)	164 (5.5)	0.72 (0.45 – 1.14)
Anxiety disorder	842 (21.8)	867 (4.6)	6.01 (5.37 – 6.73) ***	778 (23.9)	718 (4.6)	7.12 (6.30 – 8.05) ***	64 (10.5)	149 (5.0)	1.91 (1.34 – 2.71) ***
OCD	210 (5.4)	99 (0.5)	10.64 (8.23 – 13.77) ***	195 (6.0)	85 (0.5)	11.59 (8.81 – 15.25) ***	15(2.5)	14 (0.5)	5.18 (2.27 – 11.84) ***
Bipolar disorder	69 (1.8)	36 (0.2)	8.34 (5.34 – 13.04) ***	66 (2.0)	28 (0.2)	10.63 (6.48 – 17.43) ***	3 (0.5)	8 (0.3)	1.91 (0.45 – 8.00)
Sleep disorder	80(2.1)	136 (0.7)	2.72 (2.01 – 3.67) ***	73 (2.2)	117 (0.7)	2.94 (2.14 – 4.04) ***	7 (1.1)	19 (0.6)	1.45 (0.52 – 4.01)
Tourette syndrome	156 (4.0)	67 (0.4)	12.12 (8.87 – 16.55) ***	145 (4.5)	51 (0.3)	14.39 (10.19 – 20.33) ***	11 (1.8)	16 (0.5)	4.43 (1.91 – 10.27) ***

a) Adjusted analysis by sex, birth year and sociodemographic risk factors (Maternal SES, region of birth, urbanicity, maternal marital status, parental immigration status, maternal and paternal age)

OR = odds ratio, CI = confidence interval

*** p <.001, ** p <.01, * p <.05

Table S7 Comparison of co-occurring with other psychiatric disorders in ASD with and without ID and by gender in the oldest birth cohort (1998 – 2002)

	ASD without ID	ASD with ID		Boys			Girls		
				ASD without ID	ASD with ID		ASD without ID	ASD With ID	
	(N = 3,255) n (%)	(N = 612) n (%)	OR (95% CI) ^a	(N = 2,410) n (%)	(N = 426) n (%)	OR (95% CI) ^a	(N = 845) n (%)	(N = 186) n (%)	OR (95% CI) ^a
ADHD	1,104 (33.9)	105 (17.2)	2.38 (1.85 – 3.05) ***	896 (37.2)	80 (18.8)	2.55 (1.91 – 3.39) ***	208 (24.6)	25 (13.4)	1.90 (1.15 – 3.15) *
Schizophrenia	204 (6.3)	32 (5.2)	1.21 (0.81 – 1.82)	131 (5.4)	22 (5.2)	1.04 (0.64 – 1.70)	73 (8.6)	10 (5.4)	1.52 (0.71 – 3.25)
Depressive disorder	827 (25.4)	29 (4.7)	8.57 (5.56 – 13.22) ***	484 (20.1)	18 (4.2)	6.77 (3.91 – 11.72) ***	343 (40.6)	11 (5.9)	13.37 (6.61 – 27.04) ***
Anxiety disorder	778 (23.9)	64 (10.5)	3.70 (2.68 – 5.10) ***	401 (16.6)	38 (8.9)	2.46 (1.65 – 3.68) ***	377 (44.6)	26 (14.0)	6.46 (3.85 – 10.85) ***
OCD	195 (6.0)	15(2.5)	2.79 (1.53 – 5.07) ***	130 (5.4)	11 (2.6)	2.64 (1.27 – 5.49) **	65 (7.7)	4 (2.2)	3.53 (1.23 – 10.14) *
Bipolar disorder	66 (2.0)	3 (0.5)	3.19 (0.98 – 10.37)	44 (1.8)	3 (0.7)	2.11 (0.64 – 7.01)	22 (2.6)	0 (0)	N/A
Sleep disorder	73 (2.2)	7 (1.1)	2.56 (1.01 – 6.48) *	50 (2.1)	5 (1.2)	2.11 (0.74 – 5.99)	23 (2.7)	2 (1.1)	3.95 (0.51 – 30.86)
Tourette syndrome	145 (4.5)	11 (1.8)	2.09 (1.11 – 3.92) *	128 (5.3)	9 (2.1)	2.17 (1.08 – 4.36) *	17 (2)	2 (1.1)	2.61 (0.51 – 13.45)

a) Adjusted analysis by sex, birth year and sociodemographic risk factors (Maternal SES, region of birth, urbanicity, maternal marital status, parental immigration status, maternal and paternal age)

OR = odds ratio, CI = confidence interval

*** p <.001, ** p <.01, * p <.05