Handedness and 23 early life characteristics in 37,495 Dutch twins

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SUPPLEMENTARY INFORMATION

Supplementary Table 1. Overview of the association studies of handedness and early life characteristics

First author, year	Sample size	Age of handedness measurement	Handedness measurement	Handedness phenotype	Characteristics associated with handedness	Characteristics not associated with handedness
Mixed twin-singleton population studies						
De Kovel, 2019	421,776	40-69 years	Self-report	RH/LH	Being multiple, year of birth, sex, season of birth, birthweight, being breastfed	Maternal smoking
Vuoksimaa, 2009	30,161	18-69 years	Self-report on childhood and current hand preference	LH in RH/LH/MH	Being multiple, sex	Zygosity, birth order
				MH in RH/LH/MH	Sex; higher MH in triplets vs singletons and twins	Zygosity, birth order
				RH/NRH	Birthorder	
Dragovic, 2013	1,031	Mean 16.2	Self-report	RH/NRH	Maternal smoking, low Apgar scores	Being multiple, birth order, parental age, mode of delivery
Singleton studies						
Hujoel, 2019	62,129	Children	Different measurements in meta-analysis	RH/NRH	Being breastfed	None
Searleman, 1989	46,699	Children-adults (meta-analysis)	Different measurements in meta-analysis	RH/NRH	Mode of delivery, gestational age, sex, birthweight, fetal presentation, maternal smoking, birth order position in family	Mother's age at birth, being multiple
Zhu, 2009	35,206	7 years	Report on "Which hand does your child use most?" or "Is your child right-handed or left-handed?" (3 response categories: RH, LH, both) and Annett Hand Preference Questionnaire	RH/MH	Gestational age, parental handedness, mode of conception, maternal smoking, contraception during 1st trimester	None
Denny, 2012	21,847	7 years	Mother's survey	RH/NRH (LH+ MH)	Being breastfed	
Van der Feen, 2020	20,539	Mean 41.3	Hand skill assessed by alternating key press task ("tapping task")	Continuous	Aggression score	None

First author, year	Sample size	Age of handedness measurement	Handedness measurement	Handedness phenotype	Characteristics associated with handedness	Characteristics not associated with handedness
Johnston, 2013	12,686	Mean 7.4	Question on writing hand	RH/LH	Being breastfed, sex, parental age at birth, birthweight	Mode of delivery, gestational age, maternal smoking, socio-economic status
Domellof, 2011	10,117	3-19 years	Different measurements in meta-analysis	RH/NRH	Gestational age, neurological and neuropsychological outcomes	None
BaileyMcKeever, 2004	2,151	Undergraduate students	Writing hand	RH/LH	Mother's age at birth	List of 25 factors, including mode of delivery, gestational age, birthweight, fetal presentation
Van der Hoorn, 2010	2,096	Mean 13.6	Report on "What is the hand you are writing with?" (3 response categories: RH, LH, alternating)	RH/NRH	Thought problems, social problems, being withdrawn and depressed (psychotic items)	Obstetric factors (gestational age, birthweight, caesarean section, vacuum or forceps assisted birth), treated with oxygen or incubator as neonate, externalizing problems
Sutcliffe, 2005	1,525	5 years	McCarthy Scale of children's abilities (motor scale), parental report: child handedness for drawing and writing.	Continuous	None	Parental handedness, mode of conception
Fagard, 2021	1,129	5 years	Handedness index based on 8-item hand preference test (from LH to RH) and absolute handedness index (from non-lateralized to non-lateralized). Binomial variable based on handedness index: RH vs LH.	Continuous and RH/LH	Father's handedness, season of birth, gestational age, fetal presentation (breech), being breastfed	Sex, mother's handedness
Karev,2008	870	Mean 16.6	Drawing hand (Chapman and Chapman's inventory)	RH/MH/LH	None	Parental age at birth, season of birth
Obel, 2003	824	3 years	Mixed-handedness based on maternal report at 3 years old (use of hand in 5 activities)	RH/MH	Prenatal stress in 3d trimester	None
Logue, 2015	692	4-18 years (clinical setting, predominantly	Writing hand	RH/LH	Psychiatric diagnosis including oppositional defiant disorder	None

First author, year	Sample size	Age of handedness measurement	Handedness measurement	Handedness phenotype	Characteristics associated with handedness	Characteristics not associated with handedness
		African-American ancestry)				
Dinsdale, 2011	395	Mean 19.2	Edinburgh Inventory of Handedness	Continuous	Aggression score	Sex
van der Elst, 2021	294	5.67-15.08 years	Lateral preference (hand, foot, eye, ear preference)	RH/LH (LH+MH)	None	Sex, fetal presentation, mode of delivery
Marlow, 2007	241	6 years	Neuropsychological battery (fingertip tapping)	Continuous	Gestational age	None
Van Heerwaarde, 2020	179	5 years	Movement Assessment Battery for Children second edition, Dutch version (MABC-2-NL): "the hand used to write or draw with" at school age in preterm clinical group (<28 weeks GA)	RH/NRH (MH and LH combined)	Parental handedness, gestational age	Being multiple, sex, season of birth, birthweight, Apgar scores, parental education level
Gutteling, 2007	110	6 years	Hand preference based on 8 activities assessed by independent observers	RH/MH	Gestational age, mother's handedness, prenatal stress	None
Twin studies						
Sicotte, 1999	19,938	Children-adults (meta-analysis)	Different measurements in meta-analysis	RH/LH	Being multiple	Zygosity
van Beijsterveldt, 2016	1,8222	5 years	Parental report about which hand is used for drawing at the survey of age 5	RH/LH/MH	None	Chorionicity
Medland, 2003	14,838	Children-adults (meta-analysis)	Self-report on "Which hand would you use to write a letter?" and "Which hand would you use to throw a ball to hit a target"	RH/LH	None	Birth order, being multiple, zygosity
Vuoksimaa, 2010	4,736	14 years	Self-report	RH/LH/MH	Sex	Birth order
Ooki, 2006	4,164	1-15 years	Parental report on "Which hand would your twin children	RH/LH	None	Being multiple

First author, year	Sample size	Age of handedness measurement	Handedness measurement	Handedness phenotype	Characteristics associated with handedness	Characteristics not associated with handedness
			predominantly use, if possible, to write a letter?"			
Orlebeke, 1996	3,400	Mean 17.8	Report on "Do you consider yourself predominantly right-handed or predominantly left-handed?"	RH/LH	Birth order, being multiple, zygosity	None
Heikkila_2015	2,252	Mean 12 [1-36 years]	Parental report and self-report	RH/LH	Birthweight (in triplets)	None
Derom, 1996	1,616	6 - 28 years	Parental report	RH/LH	Being multiple	Sex, birth order, chorionicity, zygosity
Elkadi, 1999	1,476	Mean 23.5	Survey on hand use for 3 activities	Continuous	None	Birth order
James&Orlebeke, 2002	606	Mean 17.8	Report on "Do you consider yourself predominantly right-handed or predominantly left-handed?"	RH/LH	Birth order	None

Abbreviations: LH, left-handedness; RH, right-handedness; MH, mixed-handedness; NRH, non-right-handedness; Continuous, score measurement. The studies in the table are ordered by sample size in three groups: mixed twin-singleton population studies, singleton population studies, and twin studies.

Supplementary Table 2. Early life characteristics included in the analysis of association with handedness

	Characteristic	Type	Codification in our study	Expected association with handedness (non-right-handedness)	Reference* (First author, year)
			General characteristics		
1	Sex (being male)	Categorical	Female = 0, Male = 1	Effect of being male	de Kovel, 2019 (RH/LH)
2	Year of birth	Continuous	Scaled	Strong effect	de Kovel, 2019 (RH/LH)
3	Mother's handedness	Categorical	LH: RH = 0, LH =1 MH: RH = 0, MH = 1 NRH: RH = 0, NRH = 1	Strong effect	Johnston, 2010 (RH/LH), Zhu, 2010 (RH/MH)
4	Father's handedness	Categorical	LH: RH = 0, LH =1 MH: RH = 0, MH = 1 NRH: RH = 0, NRH = 1	Strong effect	Zhu, 2010 (RH/MH), Fagard, 2021 (Handedness score)
			Prenatal characteristics		
5	Mother's age at birth	Continuous	Scaled	Effect of older mother's age	Bailey&McKeever, 2004 (RH/LH); Johnston, 2010 (RH/LH)
6	Father's age at birth	Continuous	Scaled	No effect	Karev, 2008 (RH/LH, RH/MH)
7	Mode of conception	Categorical	Spontaneous = 0, Artificial (with hormones/ IVF/ICSI/IUI) = 1	Effect of being conceived with ART	Zhu, 2010 (RH/MH)
8	Prenatal maternal smoking	Categorical	No = 0, yes = 1	No effect	de Kovel, 2019 (RH/LH)
9	Maternal stress during pregnancy	Categorical	No = 0, yes = 1	Effect	Searleman, 1989 (RH/NRH); Obel, 2003 (RH/MH); Gutteling, 2007 (RH+LH/MH)
			Perinatal characteristics		
10	Season of birth (being born in summer)	Categorical	Summer months = 1, other months = 0	Being born in the summer	de Kovel, 2019 (RH/LH)
11	Fetal presentation at birth	Categorical	Cephalic = 0, non-cephalic (breech and horizontal) = 1	Effect of non-cephalic presentation (breech presentation)	Sealerman, 1989 (RH/NRH); Fagard, 2021 (Handedness score)
12	Mode of delivery	Categorical	Vaginal spontaneous=0, intervention (caesarean section, vacuum/forceps extraction) = 1	Effect of instrumental delivery or no effect	Sealerman, 1989 (RH/NRH) *No effect:* Bailey&McKeever 2004 (RH/LH); Van der Elst, 2011 RH/LH (LH+MH); Johnston, 2010 (RH/LH)
13	Gestational age	Continuous Categorical	Scaled <37 weeks, ≥37 weeks	Effect of preterm birth or no effect	Zhu, 2010 (RH/MH); Domellof, 2011 (RH/LH, RH/NRH); van Heerwaarde, 2020 (RH/LH, RH/NRH) *No effect:* Bailey&McKeever, 2004 (RH/LH); Johnston, 2010 (RH/LH)
14	Birthweight	Continuous Categorical	Scaled <2500g, >2500g	Effect of low birthweight	de Kovell, 2019 (RH/LH)
15	Apgar score	Continuous Categorical	1-10 points, scaled <7 points, ≥7 points	Effect of low Apgar score or no effect	Dragovic, 2013 (RH/NRH). *No effect:* van Heerwaarde l, 2020 2020 (RH/LH, RH/NRH)
			Postnatal characteristics		
16	Breastfeeding	Categorical	No = 0, yes = 1	Effect of being non-breastfed	de Kovel, 2019 (RH/LH); Hujoel, 2019 (RH/NRH), Denny,

					2012 (RH/LH, RH/NRH), Johnston, 2010 (RH/LH)
17	Neurodevelopmental delay at 5 years old	Categorical	No delay = 0, delay = 1	More NRH in children with neurodevelopmental delay	
18	Aggression score at 7 years old	Continuous Categorical	Scaled <5 points, ≥5 points	More NRH in children with higher aggression score	van der Feen, 2020; Dinsdale, 2011 *No effect:* van der Hoorn, 2010
Twin-specific characteristics					
19	Birthorder	Categorical	1st born = 0, 2nd born = 1	More NRH in 1st born	Derom, 1996 (RH/LH); Orlebeke, 1997 (RH/LH)
20	Zygosity	Categorical	DZ = 0, MZ = 1	More NRH in MZ compared to DZ	Orlebeke, 1997 (RH/LH)
21	Chorionicity	Categorical	DC = 0, MC = 1	No effect	Derom, 1996 (RH/LH); Carlier, 1996 (Handedness scores)
22	Amnionicity	Categorical	DA = 0, MA = 1	No effect or more NRH in MA compared to DA	
23	Time interval between the birth of the 1st and 2nd twin	Continuous Categorical	Scaled ≤30 minutes, >30 minutes	Effect of longer time interval between birth of twins	

RH, right-handed; LH, left-handed; MH, mixed-handed; NRH, non-right-handed; DZ, dizygotic; MZ, monozygotic; DC, dichorionic; MC, monochorionic; DA, diamniotic; MA, monoamniotic

* for characteristics not available in study of de Kovel et al, 2019, references on largest studies are reported.

Supplementary Table 3. Cross-tabulation of handedness defined by drawing on paper and other items on handedness from the NTR survey at 5 years old

		Which hand do the children usually use to: draw on paper?				
		left-handed	right-handed	no hand preference	"I don't know"	Total
Which hand do the children usually use to: drink from a cup?	left-handed	4695	223	50	3	4971
		85.90%	0.70%	10.20%	5.80%	13.40%
	right-handed	374	29929	198	11	30512
		6.80%	**95.90%**	40.40%	21.20%	82.00%
	no hand preference	329	897	237	4	1467
		6.00%	2.90%	**48.40%**	7.70%	3.90%
	"I don't know"	65	166	5	34	270
		1.20%	0.50%	1.00%	65.40%	0.70%
	Total	5463	31215	490	52	37220
Which hand do the children usually use to: eat?	left-handed	5035	223	56	5	5319
		91.50%	0.70%	11.30%	9.60%	14.30%
	right-handed	290	30364	208	8	30870
		5.30%	**97.10%**	41.90%	15.40%	82.70%
	no hand preference	155	628	232	0	1015
		2.80%	2.00%	**46.80%**	0.00%	2.70%
	"I don't know"	21	43	0	39	103
		0.40%	0.10%	0.00%	75.00%	0.30%
	Total	5501	31258	496	52	37307
Which hand do the children usually use to: throw a ball?	left-handed	4592	230	49	2	4873
		84.30%	0.70%	10.00%	3.80%	13.10%
	right-handed	373	29466	151	4	29994
		6.90%	**94.70%**	30.80%	7.70%	80.80%
	no hand preference	328	984	277	6	1595
		6.00%	3.20%	**56.50%**	11.50%	4.30%
	"I don't know"	151	451	13	40	655
		2.80%	1.40%	2.70%	76.90%	1.80%
	Total	5444	31131	490	52	37117
Which hand do the children usually use to: pick up a coin?	left-handed	4543	264	45	2	4854
		83.70%	0.80%	9.10%	3.90%	13.10%
	right-handed	312	28847	137	3	29299
		5.80%	**92.70%**	27.70%	5.90%	79.00%
	no hand preference	415	1408	289	3	2115
		7.60%	4.50%	**58.40%**	5.90%	5.70%
	"I don't know"	156	591	24	43	814
		2.90%	1.90%	4.80%	84.30%	2.20%
	Total	5426	31110	495	51	37082
Which hand do the children usually use to: comb hair?	left-handed	4346	204	40	4	4594
		79.90%	0.70%	8.10%	7.70%	12.40%
	right-handed	319	27958	138	4	28419
		5.90%	**89.90%**	28.00%	7.70%	76.60%
	no hand preference	315	1102	233	1	1651
		5.80%	3.50%	**47.40%**	1.90%	4.50%
	"I don't know"	459	1832	81	43	2415
		8.40%	5.90%	16.50%	82.70%	6.50%
	Total	5439	31096	492	52	37079
Which hand do the children usually use to: thumb suction during sleep?	left-handed	1389	2207	47	0	3643
		26.50%	7.40%	10.10%	0.00%	10.30%
	right-handed	449	8851	68	4	9372
		8.60%	**29.70%**	14.60%	7.70%	26.40%
	no hand preference	198	1219	61	4	1482
		3.80%	4.10%	**13.10%**	7.70%	4.20%
	"I don't know"	3206	17478	290	44	21018
		61.20%	58.70%	62.20%	84.60%	59.20%
	Total	5242	29755	466	52	35515

Supplementary Table 4. Prevalence of right-handedness, left-handedness and mixed-handedness in twins by parental handedness

	RH both parents (RH_RH)	NRH one parent (NRH_RH)	P NRH_RH vs RH_RH	NRH both parents (NRH_NRH)	P NRH_NRH vs RH_RH
Left-handedness	13.8% (n=3120)	18% (n=1409)	1.79E-19	24.04% (n=176)	6.48E-15
Mixed-handedness	1.2% (n=276)	1.41% (n=110)	0.226	1.1% (n=8)	0.892
Non-right-handedness	15.0% (n=3396)	19.41% (n=1519)	7.85E-20	25.14% (n=184)	1.02E-13

Appendix 1. Neurodevelopmental delay

The variable "Neurodevelopmental delay" was created based on two variables – delay in bowel control toilet skill and delay in bladder control toilet skill at 5 years based on questions "How often do the children poop in their pants?" and "How often do the children pee in their pants during the day?". Answers for both questions were "Never", "<1 per month", "1 per month", "1 per week", and "Every day". Coding of both variables was 1 = delay (answer "Every day"), 0 = no delay (other answers).

Crosstab of bladder and bowel skill delay

|		Bowel control toilet skill delay		
		No delay	Delay	NA
Bladder control toilet skill delay	No delay	36073	145	47
	Delay	524	174	6
	NA	132	5	389

Neurodevelopmental delay variable:
Coded as '0': bladder and/or bowel control toilet skill delay = "No delay" (blue in the table);
Coded as '1': bladder and/or bowel control toilet skill delay = "Delay" (red in the table)
N_{cases} = 37106, of them $N_{no\ delay}$ = 36252, N_{delay} = 854.
$N_{missing}$ = 389.
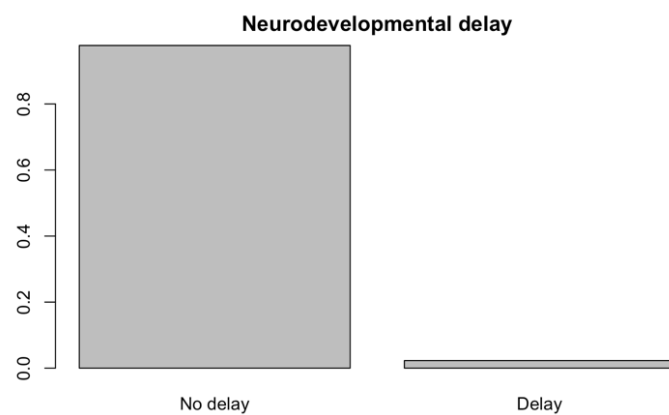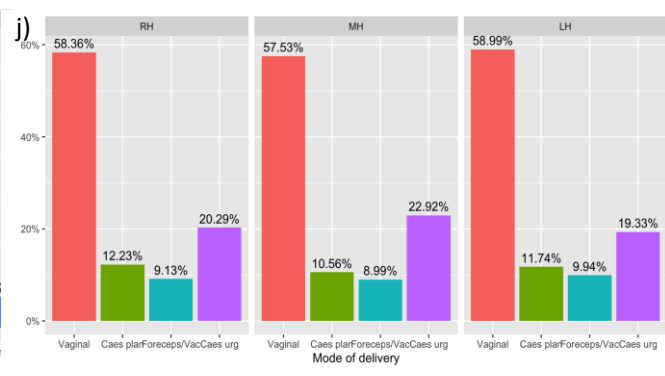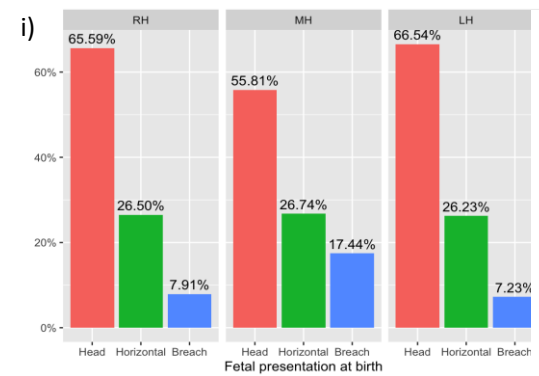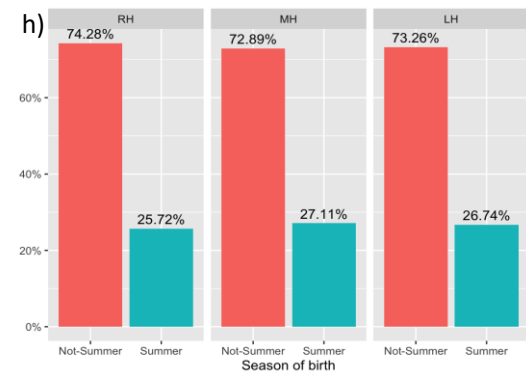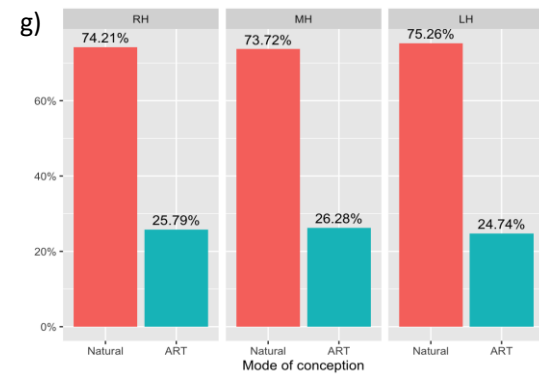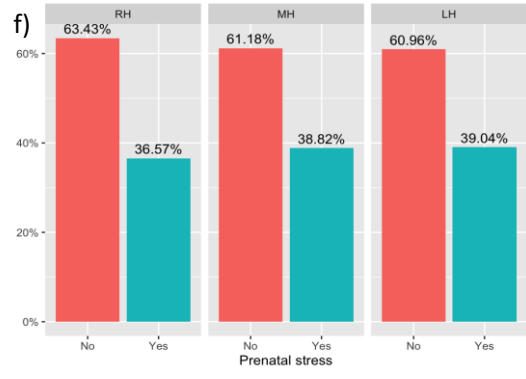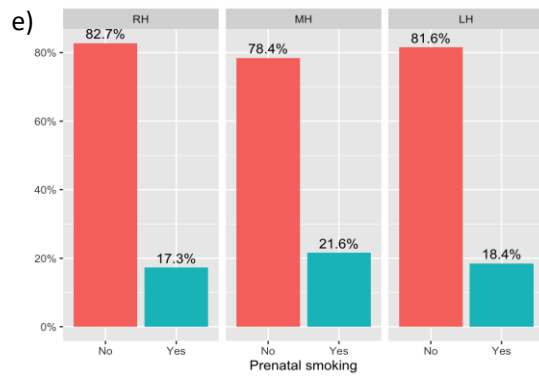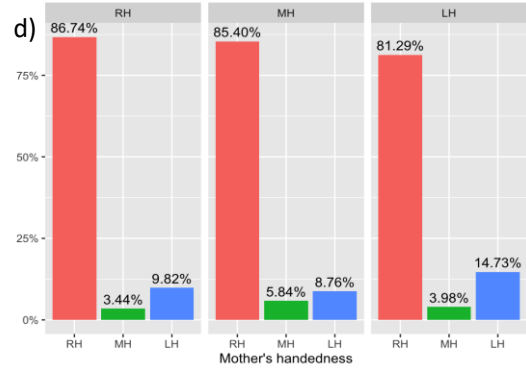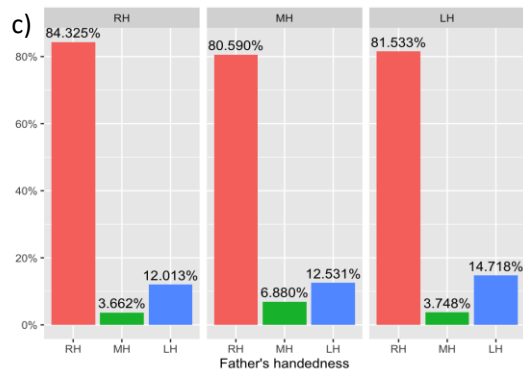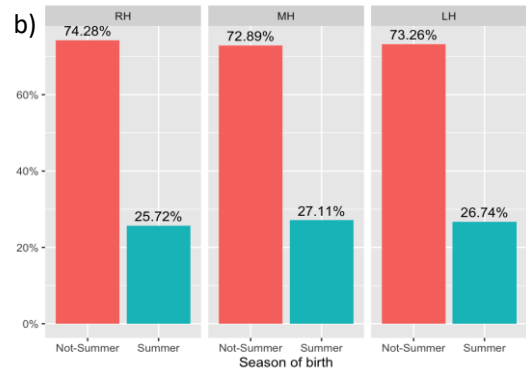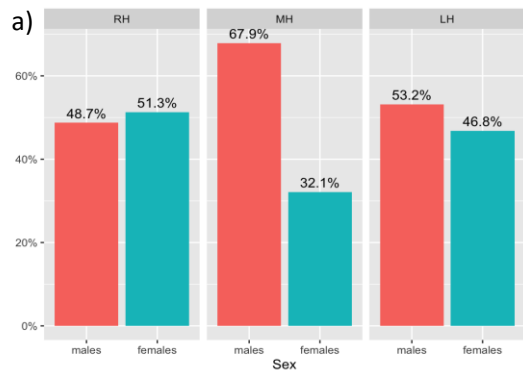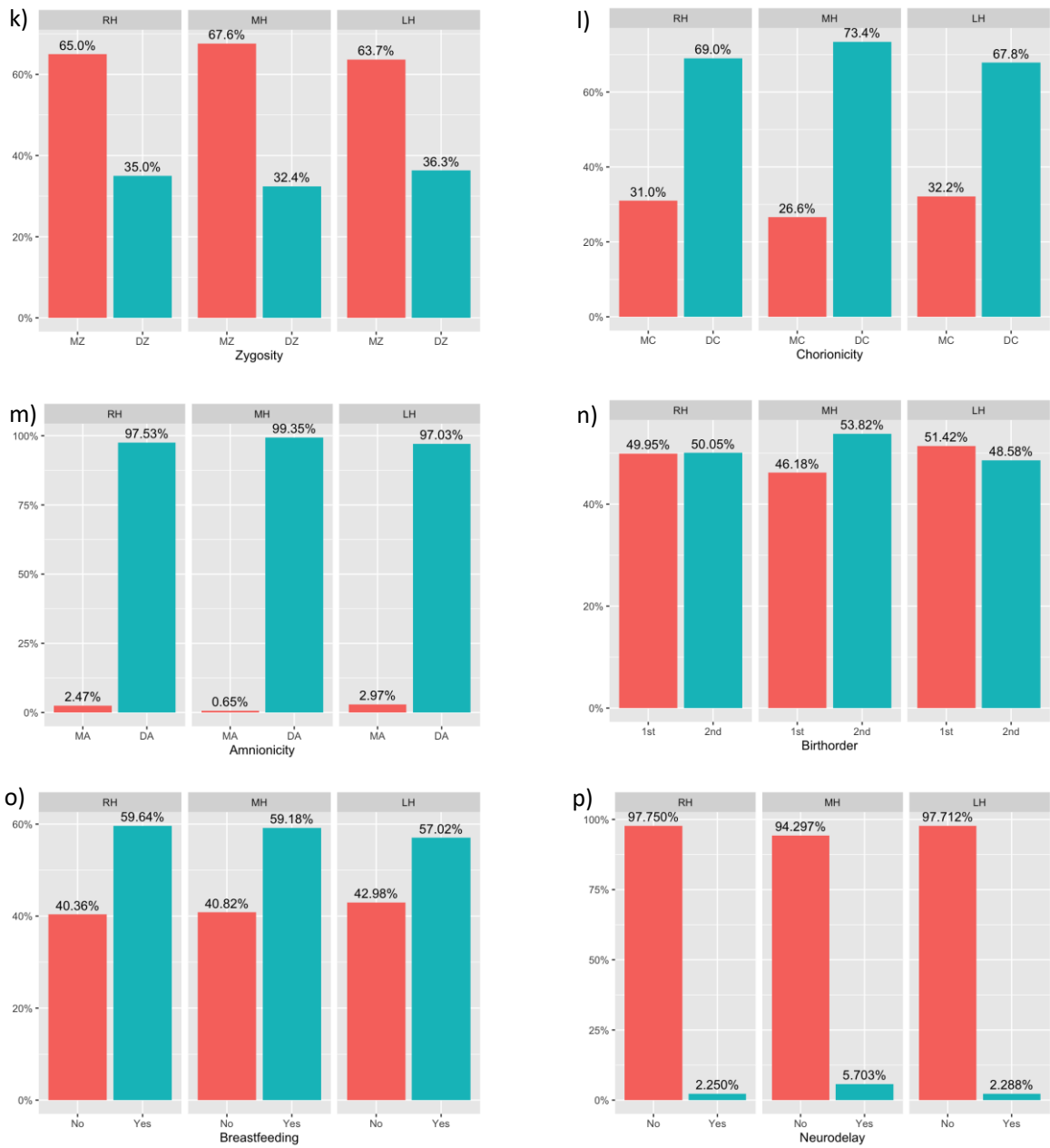
Supplementary Figure 1. Frequencies in categorical early life characteristics in right-handed (RH), mixed-handed (MH) and left-handed (LH) children

Supplementary Figure 2. Boxplots of continuous early life characteristics in right-handed (RH), mixed-handed (MH) and left-handed (LH) children

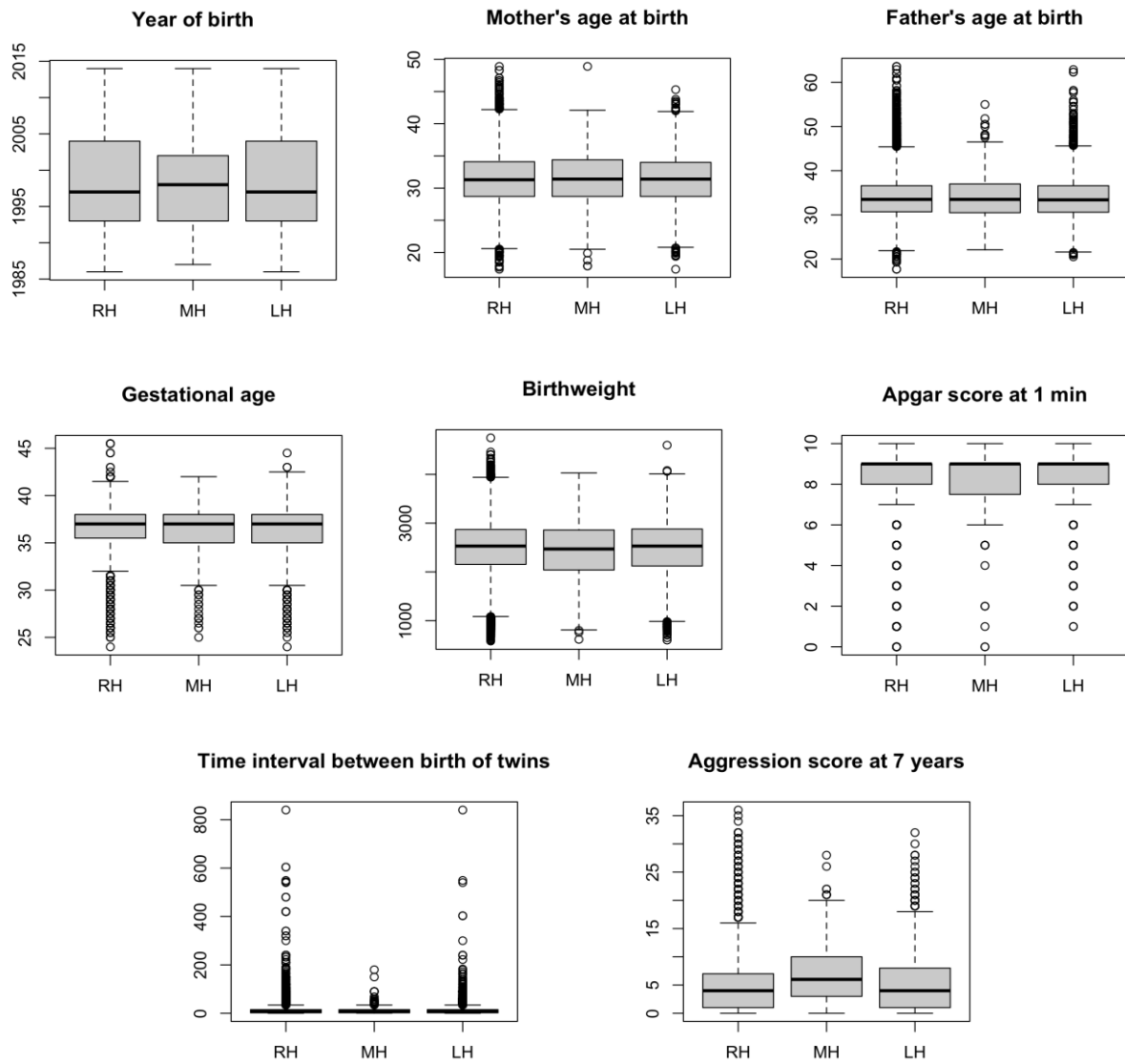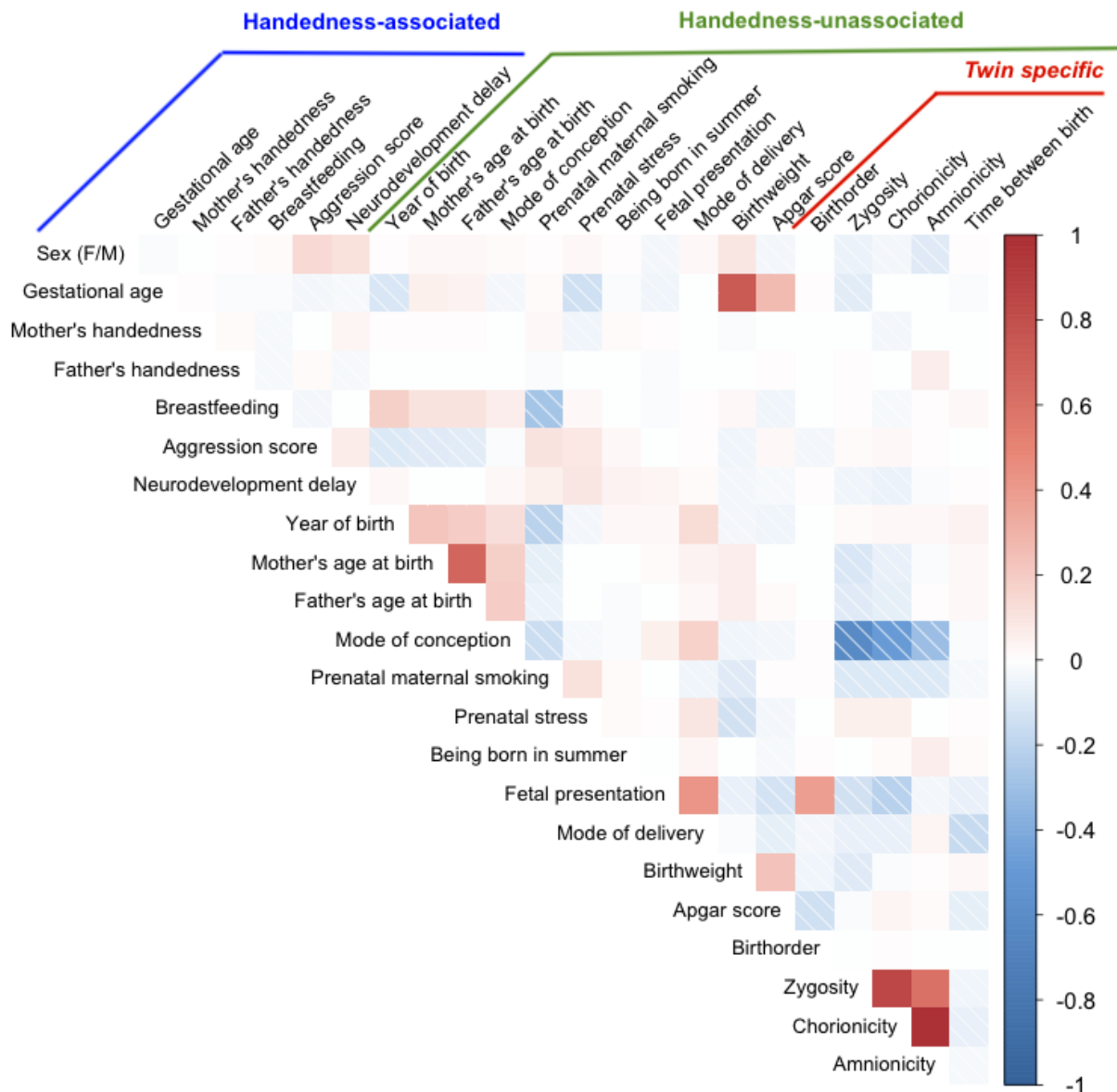**Supplementary Figure 3.** Correlations between 23 early life characteristics

Pearson correlations between continuous variables, polychoric correlations between ordinal variables, and point biserial correlations between continuous and ordinal variables. Handedness-associated are the characteristics that were associated with handedness in one of three definitions in regression analysis at p<0.0011. Handedness-unassociated are the characteristics that were not associated with handedness in regression analysis. For coding of variables see **Supplementary Table 1**. N = 37,495.

Appendix 2. Multiple testing correction

The correction suggested by Nyholt (2004) involves calculating the effective number of tests given the currelations among the predictors. The effective number of tests (M_{eff}) taking in account the proportional reduction in the number of variables in a set that is the ratio of observed eigenvalue variance to its maximum is calculated as:

$$M_{eff} = 1 + (M - 1)\ (1 - (Var(\lambda_{obs})/M),$$

where M is the total number of variables included in the correlation matrix, $Var(\lambda_{obs})$ is the observed eigenvalue variance derived from correlation matrix (Nyholt, 2004).

There were 23 early life characteristics (predictors) in the current study. Number of calculations $23*24/2 - 23 = 253$ correlations (mean 0.14, sd 0.14, range [-0.62 : 0.98]). Distribution of correlation coefficients between 23 early life characteristics is presented on histogram:
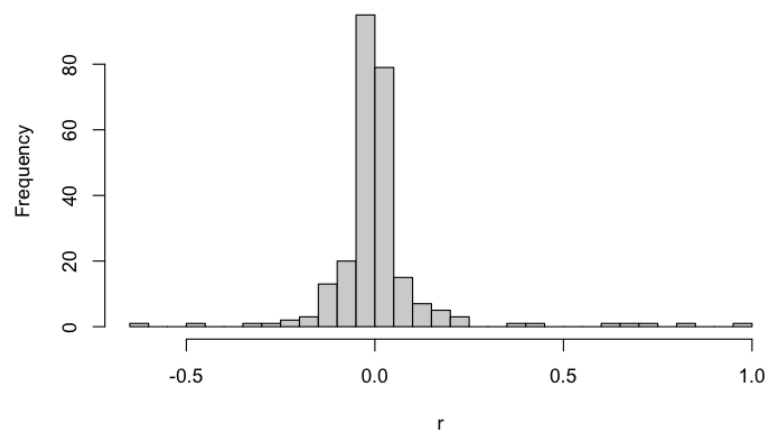
$M_{eff} = 1 + (23 - 1)\ (1 - (0.472507/23)$. The effective number of tests is 22.5. Given two definitions of handedness (left-handedness and mixed-handedness), alpha-per-test equalled $\alpha = 0.05/(22.5*2) = 0.001108744$.

Supplementary Table 5. Results of univariate regression analysis

	RH vs LH					RH vs MH					RH vs NRH				
	N	β	SE	z	P	N	β	SE	z	P	N	β	SE	z	P
General characteristics															
Sex (F/M)	36,997	0.183	0.030	6.199	6.68E-10	31,923	0.811	0.100	8.113	1.39E-16	37,495	0.232	0.029	8.120	4.66E-16
Year of birth (scaled)	36,997	-0.010	0.015	-0.668	0.526	31,923	0.028	0.044	0.638	0.621	37,495	-0.007	0.015	-0.485	0.628
Mother's handedness*	30,349	0.470	0.047	9.976	1.14E-23	26,179	-0.109	0.197	-0.556	0.034	31,869	0.387	0.041	9.335	6.74E-21
Father's handedness*	30,088	0.236	0.047	5.036	3.05E-07	25,922	0.078	0.162	0.482	0.002	31,643	0.202	0.041	4.950	4.75E-07
Prenatal characteristics															
Mother's age at birth (scaled)	35,885	-0.019	0.015	-1.269	0.199	30,955	0.001	0.054	0.016	0.912	36,364	-0.018	0.015	-1.240	0.204
Father's age at birth (scaled)	35,520	-0.012	0.015	-0.749	0.454	30,621	0.043	0.054	0.797	0.453	35,990	-0.007	0.015	-0.477	0.626
Mode of conception (Natural/Assisted)	34,058	-0.056	0.036	-1.558	0.133	29,380	0.027	0.111	0.243	0.764	34,526	-0.049	0.034	-1.424	0.173
Maternal smoking (no/yes)	35,878	0.081	0.039	2.076	0.039	30,945	0.280	0.121	2.302	0.015	36,360	0.099	0.038	2.607	0.009
Prenatal stress (no/yes)	7,117	0.107	0.071	1.505	0.135	6,134	0.103	0.226	0.456	0.642	7,202	0.105	0.069	1.522	0.126
Perinatal characteristics															
Gestational age (scaled)	35,795	-0.055	0.015	-3.764	0.00016	30,883	-0.175	0.046	-3.833	4.92E-05	36,277	-0.066	0.014	-4.640	2.55E-06
Being born in summer (no/yes)	36,993	0.053	0.034	1.558	0.102	31,919	0.071	0.111	0.639	0.473	37,491	0.054	0.033	1.650	0.083
Fetal presentation (cephalic/non-cephalic)	7,182	-0.044	0.070	-0.630	0.479	6,189	0.399	0.220	1.809	0.077	7,268	-0.009	0.067	-0.134	0.826
Mode of delivery (vaginal/instrumental)	31,373	-0.026	0.033	-0.791	0.426	27,090	0.018	0.102	0.180	0.799	31,818	-0.021	0.032	-0.656	0.510
Birth weight (scaled)	35,568	-0.023	0.015	-1.538	0.125	30,677	-0.147	0.051	-2.895	0.002	36,045	-0.034	0.015	-2.318	0.019
Apgar score 1 min (scaled)	5,217	0.016	0.023	0.684	0.506	4,515	-0.133	0.059	-2.247	0.025	5,281	0.001	0.022	0.054	0.971
Postnatal characteristics															
Breastfeeding (no/yes)	31,624	-0.107	0.033	-3.289	0.00099	27,261	-0.001	0.109	-0.006	0.953	32,038	-0.100	0.032	-3.184	0.0014
Neurodevelopmental delay (no/yes)	36,615	0.019	0.098	0.197	0.844	31,599	0.920	0.218	4.225	2.38E-05	37,106	0.134	0.091	1.466	0.143
Aggression score at 7 y (scaled)	20,327	0.022	0.019	1.157	0.244	17,516	0.325	0.048	6.846	1.46E-12	20,595	0.053	0.018	2.892	0.004
Twin-specific characteristics															
Birthorder (1st/2nd)	36,968	-0.059	0.028	-2.077	0.042	31,896	0.164	0.084	1.948	0.077	37,465	-0.041	0.027	-1.503	0.138
Zygosity (DZ/MZ)	36,827	-0.056	0.031	-1.790	0.076	31,777	0.119	0.106	1.122	0.261	37,321	-0.042	0.030	-1.386	0.169
Chorionicity (DC/MC)	11,043	0.055	0.059	0.923	0.347	9,544	-0.209	0.201	-1.040	0.304	11,201	0.032	0.057	0.557	0.567
Amnionicity (DA/MA)	11,000	0.190	0.167	1.143	0.260	9,506	-1.396	1.004	-1.391	0.153	11,155	0.119	0.164	0.723	0.479
Time between birth of 1st and 2nd twin (scaled)	30,312	0.022	0.014	1.517	0.113	26,167	-0.059	0.067	-0.880	0.368	30,746	0.017	0.015	1.246	0.213

β, regression coefficient, SE, standard error; z, z-statistics; *P*, p-value. GEE with correction for relatedness. RH, right-handed; LH, left-handed; MH, mixed-handed; NRH, non-right-handed (LH+MH); MZ, monozygotic; DZ, dizygotic; MC, monochorionic; DC, dichorionic; MA, monoamniotic; DA, diamniotic. *Mother's and father's handedness are included in the same definition as the offspring handedness.

Supplementary Table 6. Prevalence of handedness in term and preterm twin births

	Full-term >37 weeks	Preterm <37 weeks	*P*
Left-handedness	14.39% (n=3102)	15.58% (n=2292)	0.00018
Mixed-handedness	1.21% (n=261)	1.5% (n=221)	0.019
Non-righthandedness	15.60% (n=3363)	17.08% (n=2513)	0.00017

$N_{full-term}$=21563. $N_{preterm}$=14714. *P*, *p*-value in 2-sample test for equality of proportions.

Supplementary Table 7. Prevalence of left-handedness, mixed-handedness and non-right-handedness in same-sex and opposite-sex twins

	Females from same-sex pairs (SSF)	Females from opposite-sex pairs (OSF)	*P* SSF vs OSF	Males from same-sex pairs (SSM)	Males from opposite-sex pairs (OSM)	*P* SSM vs OSM
Left-handedness	14.22% (n=1818)	12.91% (n=776)	0.017	15.71% (1970)	16.38% (980)	0.255
Mixed-handedness	0.8% (n=102)	0.93% (n=56)	0.393	1.72% (216)	2.01% (120)	0.197
Non-right-handedness	15.01% (n=1920)	13.85% (n=823)	0.037	17.43% (2186)	18.38% (1100)	0.118

N_{SSF} = 12788, N_{OSF}=6009, N_{SSM}=12540, N_{OSM}= 5984. *P*, *p*-value in 2-sample test for equality of proportions.