Supplementary Material

SEARCH STRATEGY PUBMED

("Congenital Abnormalities"[Mesh:NoExp] OR congenital abnormalit*[tiab] OR congenital deformit*[tiab] OR congenital defect*[tiab] OR birth defect*[tiab] OR congenital anomal*[tiab] OR "Esophageal Atresia"[Mesh] OR esophageal atresia*[tiab] OR oesophageal atresia*[tiab] OR "Gastroschisis"[Mesh] OR gastroschis*[tiab] OR Congenital Fissure of the Abdominal Cavity[tiab] OR ("Hernia, Umbilical"[Mesh] AND congenital*[tiab]) OR exomphalos[tiab] OR omphalocele*[tiab] OR "Hirschsprung Disease"[Mesh] OR hirschsprung disease[tiab] OR congenital megacolon[tiab] OR hirschsprung's disease[tiab] OR hirschsprungs disease[tiab] OR aganglionic megacolon[tiab] OR Rectosigmoid Colon Aganglionosis[tiab] OR Rectosigmoid Aganglionosis[tiab] OR Congenital Intestinal Aganglionosis[tiab] OR Colonic Aganglionosis[tiab] OR Total Colonic Aganglionosis[tiab] OR "Anorectal Malformations"[Mesh] OR Anorectal Malformation*[tiab] OR Anorectal Anomal*[tiab] OR Anorectal Atresia*[tiab] OR Anorectal Stenos*[tiab] OR "Anus, Imperforate"[Mesh] OR imperforate anus[tiab] OR anal atresi*[tiab] OR "Short Bowel Syndrome"[Mesh] OR Short Bowel Syndrome*[tiab] OR intestinal failure[tiab] OR pediatric intestinal failure[tiab] OR paediatric intestinal failure[tiab] OR "Intestinal Atresia"[Mesh] OR Congenital Intestinal Atresia*[tiab] OR Apple Peel Syndrome*[tiab] OR Apple-Peel Intestinal Atresia*[tiab] OR Jejunal Atresia[tiab] OR Apple Peel Small Bowel Syndrome[tiab] OR Familial Apple Peel Jejunal Atresia[tiab]) AND (Infan*[tiab] OR newborn*[tiab] OR new-born*[tiab OR perinat*[tiab] OR neonat*[tiab] OR baby[tiab] OR baby*[tiab] OR babies[tiab] OR toddler*[tiab] OR minors[tiab] OR minors*[tiab] OR boy[tiab] OR boys[tiab] OR boyfriend[tiab] OR boyhood[tiab] OR girl*[tiab] OR kid[tiab] OR kids[tiab] OR child[tiab] OR child*[tiab] OR children*[tiab] OR schoolchild*[tiab] OR schoolchild[tiab] OR school child[tiab] OR school child*[tiab] OR adolescen*[tiab] OR juvenil*[tiab] OR youth*[tiab] OR teen*[tiab] OR under*age*[tiab] OR pubescen*[tiab] OR pediatrics[mesh] OR pediatric*[tiab] OR paediatric*[tiab] OR peadiatric*[tiab] OR school[tiab] OR school*[tiab] OR prematur* OR preterm*) AND ("Child Development"[Mesh] OR Child Development[tiab] OR Infant Development[tiab] OR neurocogniti*[tiab] OR neuropsych*[tiab] OR cogniti*[tiab] OR neurodevelopment*[tiab] OR developmental[tiab] OR motor*[tiab] OR movement[tiab] OR psychomotor[tiab] OR intell*[tiab] OR intellect*[tiab] OR intellectual[tiab] OR intelligence[tiab] OR psychomotor performanc*[tiab] OR neurocognitive performanc*[tiab] OR psychomotor skil*[tiab] OR neurocognitive skil*[tiab] OR neuropsychological funct*[tiab] OR psychomotor funct*[tiab] OR neuropsychological outcom*[tiab] OR psychomotor outcom*[tiab] OR neurocognitive outcom*[tiab] OR "Wechsler Scales"[Mesh] OR Wechsler Scale*[tiab] OR WPPSI[tiab] OR WISC[tiab] OR Wechsler Intelligence Scale for Children[tiab] OR Wechsler Preschool and Primary Scale of

Intelligence[tiab] OR BSID[tiab] OR Bayley[tiab] OR Bayley Scales of Infant Development[tiab] OR MABC[tiab] OR Movement Assessment Battery for Children[tiab] OR AIMS[tiab] OR Alberta Infant Motor Scale[tiab] OR Infant Motor Scale[tiab] OR BOTMP[tiab] OR Bruininks-Oseretsky[tiab] OR Bruininks*[tiab] OR Griffiths[tiab] OR Griffiths Mental Development Scale[tiab] OR GMSD[tiab] OR Griffith score*[tiab] OR Mullen[tiab] OR Mullen Scales of Early Learning[tiab] OR MSEL[tiab] OR Ages and stages questionnaire[tiab] OR ASQ[tiab] OR CBCL[tiab] OR Child Behavioural Checklist[tiab] OR Child Behavioral Checklist[tiab] OR NEPSY[tiab]) AND ("Case-Control Studies"[Mesh] OR "Cohort Studies"[Mesh] OR "Observational Study" [Publication Type] OR case-control[tiab] OR cohort[tiab] OR retrospective[tiab] OR prospective[tiab] OR observational stud*[tiab] OR descriptive study[tiab] OR "Cross-Sectional Studies"[Mesh] OR cross sectional[tiab])

SELECTION OF STUDIES DESCRIBING OVERLAPPING COHORTS

In case multiple articles reported on (partly) overlapping cohorts, we included the article that: (1) reported the longest follow-up period, (2) reported separately on subgroups of patients to allow differentiation for malformation type and/or (3) had the largest sample size to maximize generalizability of the sample and statistical power of meta-analysis (decisions were made in this order).

ADJUSTED USE OF THE NEWCASTLE OTTAWA SCALE FOR QUALITY ASSESSMENT OF INCLUDED STUDIES

In accordance with the manual, the NOS tool was adjusted to enable quality assessment of observational cohort studies. One aspect of the scale ("demonstration that outcome of interest was not present at start of the study") was not applicable and was therefore omitted from quality assessment. An extra point for selection was given when studies had a design with a control group instead of using normative scores.

In accordance with the Agency for Healthcare Research and Quality (AHRQ) standards, quality of studies was considered:

- 'good', in case of a score of 3-4 points for selection of subjects AND a score of 1-2 points for comparability of cases and controls AND a score of 2-3 points for outcome measurements
- 'fair', in case of a score of 2 points for selection of subjects AND a score of 1-2 points for comparability of cases and controls AND a score of 2-3 points for outcome measurements
- 'poor', in case of a score of 0-1 points for selection of subjects OR 0 for comparability of cases and controls OR 0-1 for outcome measurements

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STUDY CHARACTERISTICS OF INCLUDED STUDIES

sTable 1 *Study characteristics of included studies*

Author	**Period of inclusion[a]**	**Country**	**Sample size[b]**	**Assessed type of malformation[b]**	**Tool[c]**	**Normative sample**	**Included in meta-analysis of overall neurodevelopmental outcome**	**Included in meta-analysis of motor outcome**	**Included in meta-analysis of cognitive outcome**	**Included in meta-analysis of language outcome**	**Age at assessment (months)[a,de,f]**	**Mean (SD) GA (wk)[a,d,f]**	**Mean (SD) BW (gram)[a,d,f]**	**Mean (SD) number of surgeries[a,d,e,f]**	**Mean (SD) length of total hospital stay[a,d,e,f]**
Aite, 2014	2008-2012	Italy	30	EA	BSID-III	Italian norm[1]	X	X	X		6 / 12	38 (2)	2635 (470)	1.1 (0.2)/ 1.2 (0.5)	NR
Beers, 2000	NR	USA	8	SB	WISC-III	North-American norm[2]	X	X	X		117	34 (3)	19889 (826)	NR	NR
Bevilacqua, 2014	2008-2010	Italy	150 (37 EA, 43	Mix	BSID-III	Italian norm[1]	X	X	X		6	38 (1)	2944 (636)	1.7 (1.5)	34.9 (23.2)

			CDH, 29 MM, 16 CAWD, 25 CR)												
			156 (38 EA, 40 CDH, 35 MM, 17 CAWD, 26 CR)	Mix	BSID-III	Italian norm[1]	X	X	X		12	38 (1)	2935 (643)	2 (1.5)	40.4 (30.7)
			84 (15 EA, 30 CDH, 19 MM, 12 CAWD, 8 CR)	Mix	BSID-III	Italian norm[1]	X	X	X		24	38 (2)	2853 (547)	2 (1.5)	40.9 (27.2)
Bevilacqua, 2015	2008-2012	Italy	41	EA	BSID-III	Italian norm[1]	X	X	X		6 / 12	38 (2)	2714 (553)	1.4 (0.8) / 1.4 (0.8)	36. 8 (27.7) / 39.4

															(30.7)
			34	IA	BSID-III	Italian norm[1]	X	X	X		6 / 12	37 (2)	2763 (667)	2 (1.5) / 2 (1.5)	56.0 (49.0) / 55.2 (48.8)
			18	GS, OM	BSID-III	Italian norm[1]	X	X	X		6 / 12	37 (2)	2614 (607)	1.4 (0.8) / 1.4 (0.8)	30.4 (9.5) / 30.4 (9.5)
			20	HD, ARM	BSID-III	Italian norm[1]	X	X	X		6 / 12	39 (2)	3326 (618)	2.3 (1.6) / 2.4 (1.8)	33.3 (26.1) / 34.5 (28.9)
Bouman, 1999	NR	Netherlands	36	EA	WISC-RN	Dutch norm[3]	X		X		122	NR	NR	3.4 (1.9)	NR
Burnett, 2018	2006-2014	Australia	39	GS	BSID-III	North-American norm[4]	X	X	X	X	2	36 (2)	2194 (400)	NR	39.6 (25.4)

			20	GS	WPPSI-III	North-American norm[5]			X		72	35 (2)	2304 (614)	NR	47.9 (41.9)
			20	OM	BSID-III	North American norm[4]	X	X	X	X	24	39 (2)	3351 (596)	NR	15.4 (14.3)
			10	OM	WPPSI-III	North American norm[5]			X		72	39 (1)	3492 (532)	NR	11.5 (7.7)
Chesley, 2016	NR	USA	15	SB	BSID-II	North American norm[6]	X	X	X		17	34 (4)	NR	11 (5.7)	145.9 (93.7)
Costerus, 2019	2011-2013	Netherlands	5	EA	BSID-II	Dutch norm[7]	X	X	X		24	38 (2)	2742 (545)	NR	NR
Danzer, 2019	2004-2015	USA	47	OM	BSID-II; BSID-III, WPPSI-III,	NR	X	X	X	X	41	35 (3)	2525 (735)	NR	132.8 (86.3)

					WPPSI-IV										
Dobersch uetz, 2016	2008-2011	Germany	40 (9 EA, 9 GS, 5 IA, 4 OM, 3 CDH, 2 ARM, 1 HD, 3 combinat ion)	Mix	BSID-II	Control group – but normative data was included	X	X	X		25	37 (2)	2782 (674)	2.0 (NR)	43.9 (40.3)
Elsinga, 2013	1995-2002	Netherlan ds	27	IA	M-ABC, WISC-III, NEPSY-II	Dutch norm[8,9,10]	X	X	X		114	36 (3)	2972 (1091)	NR	NR
Faugli, 2009	1999-2002	Norway	39	EA	BSID-II	North American	X	X	X		13	NR	2780 (926)	1.4 (0.9)	NR

						norm[11]									
Gischler, 2009	1999-2003	Netherlands	17	EA	BOS 2-30	Dutch norm[12]	X	X	X		6 / 12 / 18 / 24	39 (3)	2928 (485)	4.4 (4.0)	77.2 (78.8) / 79.8 (80.8) / NR / NR
			34	IA	BOS 2-30	Dutch norm[12]	X	X	X		6 / 12 / 18 / 24	37 (3)	2964 (697)	2 (1.5)	46.1 (44.3) / 49.0 (47.2) / NR / NR
			19	GS, OM	BOS 2-30	Dutch norm[12]	X	X	X		6 / 12 / 18 / 24	39 (3)	2744 (641)	2.3 (1.6)	48.2 (36.8) / 55.4 (52.9) / NR / NR
Giudici, 2016	2003-2013	Argentinia	27/14/13	EA	CATCLAMS /	North American	X	X	X	X	12 / 36 / 72	38 (2)	2917 (440)	NR	NR

					PRUNAPE	norm (Catclams),[13] Argentinian norm (Prunape)[14]									
Giudici, 2016	2003-2014	Argentinia	52/34/20	GS	CATCLAMS / PRUNAPE	North American norm (Catclams)[13] Argentinian norm (Prunape)[14]	X	X	X	X	12 / 36 / 72	37 (2)	2403 (427)	NR	NR
Gorra, 2012	2001-2008	USA	46	GS	BSID-II	Control group – but normative data was included	X				24	36 (NR)	2542 (NR)	NR	54.0 (NR
Harmsen, 2017	1999-2006	Netherlands	54	EA	MABC, MABC-II,	Dutch norm[8,15,9]	X	X	X		60 / 96	38 (3)	2798 (816)	NR / NR	84.6 (99.6) / NR

					WISC-III										
Harris, 2016	1992-2005	Australia	39	GS	WPPSI-III, WISC-IV	Australian norm[5,16]	X		X		120	36 (2)	2496 (174)	NR	NR
Hijkoop, 2017	2000-2012	Netherlands	54	GS	BOS 2-30, BSID-II	Dutch norm[12,7]	X	X	X		12 / 24	36 (2)	2313 (NR)	NR	NR
Huang, 2008	2005-2006	China	8	SB	BSID-I, WPPSI-R, WISC-R, WAIS-R	North American norm[17-20]	X	X	X		80	38 (1)	3291 (377)	NR	NR
Kato, 1993	1978-1983	Japan	8	GS, OM	WISC-R	NR	X		X		107	NR	NR	NR	NR
			6	HD	WISC-R	NR	X		X		101	NR	NR	NR	NR

			13	ARM	WISC-R	NR	X		X		94	NR	NR	NR	NR
Konig, 2018	NR	Germany	12	EA	KTT; DMT	Control group	X	X			84	NR	NR	NR	NR
Kubota, 2011	NR	Japan	20	EA	WISC-III	North American norm[21]	X		X		NR	NR	NR	NR	NR
			25	ARM	WISC-III	North American norm[21]	X		X		NR	NR	NR	NR	NR
Kumari, 2019	2012-2017	India	32	EA	DASII	Indian norm[22]	X		X		17	37 (3)	2360 (639)	NR	NR
Laing, 2011	2002-2004	Australia	46	Mix	BSID-II	North American norm[6]	X	X	X		24	38 (2)	3174 (578)	1.5 (0.9)	28.0 (20.8)
Ludman, 1990	1983-1984	UK	30	Mix	GMDS	Control group	X	X	X	X	12	NR	NR	NR	52.5 (65.6)
Ludman, 1993	1983-1985	UK	29	Mix	GMDS	Control group	X	X	X	X	6 / 36	NR	NR	NR / NR	NR / NR

Maheshwari, 2013	2006-2011	Australia	3	EA	BSID-III	NR	X	X	X	X	5-13	NR	NR	NR	NR
Mawlana, 2018	2000-2015	Canada	182	EA (TEF)	BSID-II	North American norm[4]	X	X	X	X	24	37 (3)	2589 (800)	NR	NR
Mazer, 2010	1999-2002	Netherlands	15	EA	BOS 2-30, MABC	Dutch norm[12,8]	X	X	X		6 / 12/ 24 / 60	NR	NR	NR / NR / NR / NR	NR / NR / NR / NR
			18	IA,	BOS 2-30, MABC	Dutch norm[12,8]	X	X	X		6 / 12/ 24 / 60	NR	NR	NR / NR / NR / NR	NR / NR / NR / NR
			27	GS, OM	BOS 2-30, MABC	Dutch norm[12,8]	X	X	X		6 / 12/ 24 / 60	NR	NR	NR / NR / NR / NR	NR / NR / NR / NR
			6	HD	BOS 2-30, MABC	Dutch norm[12,8]	X	X	X		6 / 12/ 24 / 60	NR	NR	NR / NR / NR / NR	NR / NR / NR / NR
			15	ARM	MABC, BOS 2-	Dutch norm[12,8]	X	X	X		60	NR	NR	NR	NR

					30										
Minutillo, 2013	1997-2010	Australia	67	GS	GMDS	NR	X		X		12	NR	NR	NR	NR
Moran, 2019	2011-2013	Australia	27 (10 EA, 17 CAWD)	Mix	BSID-III	Control group	X	X	X	X	26	38 (32-40)	2940 (NR)	NR	NR
More, 2014	2001-2010	Australia	31	HD	GMDS	British norm[23]	X		X		12	NR	NR	NR	NR
Newton, 2016	2001-2014	USA	34	EA (TEF)	BSID-II, BSID-III	Control group	X				35	35 (NR)	2244 (NR)	NR	57.7 (NR)
Payne, 2010	1999-2007	USA	57	GS	BSID-III	Control group	X				39	36 (NR)	2365 (NR)	NR	54.2 (42.6)
Plummer, 2019	2016-2018	USA	34	CGIA	NIH Toolbox	British norm[24]	X		X	X	56	38 (2)	3220 (690)	NR	NR
Sirichaipornsak, 2011	2007-2008	Thailand	15	GS	BSID-III	NR	X	X	X	X	22	37 (2)	2289 (477)	NR	42.4 (29.3)

So, 2016	2011-2013	Canada	33	SB	AIMS, MAI	North American norm[25,26]	X	X			11	33 (5)	1877 (1031)	2.4 (0.8)	165.5 (99.6)
So, 2019	2011-2013	Canada	30	SB	MSEL	North American norm[27]	X	X	X	X	12-15 / 26-32	33 (5)	1949 (995)	NR / NR	NR / NR
So, 2019	2015-2016	Canada	30	SB	BOT2	North American norm[28]	X	X			84	35 (5)	2198 (848)	3.6 (2.3)	198.0 (128.4)
South, 2008	2003-2005	USA	17	GS	BSID-II	North American norm[6]	X				20	36 (2)	2360 (731)	NR	NR
Van den Hondel, 2013	1999-2011	Netherlands	37	ARM	RAKIT, MABC	Dutch norm[29,8]	X	X			60	38 (NR)	3010 (NR)	3.9 (3.5)	NR
Van den Hondel, 2016	1999-2006	Netherlands	43	HD, ARM	WISC-III, RAKIT	Dutch norm[9,29]	X	X	X		96	NR	NR	NR	NR

Van der Cammen -van Zijp, 2010	1999-2003	Netherlands	29	EA	MABC	Dutch norm[8]	X	X			71	37 (3)	2839 (913)	NR	76.9 (69.3)
			25	IA	MABC	Dutch norm[8]	X	X			71	37 (3)	2747 (509)	NR	49.4 (51.2)
			24	GS, OM	MABC	Dutch norm[8]	X	X			71	38 (2)	2702 (591)		59.8 (64.5)
Van Eijck, 2013	2004-2007	Netherlands	8	OM	MABC-II	Dutch norm[15]	X	X			72	NR	NR	NR	NR
Walker, 2013	2006-2008	Australia	31	EA (TEF)	BSID-III	Control group	X	X	X	X	12	38 (NR)	2718 (717)	NR	31.1 (30.7)
Walker, 2015	2006-2008	Australia	124	Mix	BSID-III	Control group	X	X	X	X	36	NR	NR	NR	NR

[a]NR = not reported

[b]ARM = anorectal malformations; BA = biliary atresia; CGIA = Congenital Gastrointestinal Anomalies; EA = esophageal atresia; GS = gastroschisis; HD = Hirschsprungs disease; IA = intestinal atresia / midgut malformations ; NCCA = non-cardiac congenital malformations; OM = omphalocele; SB = short bowel syndrome / intestinal failure

[c]AIMS = Alberta Infant Motor Scales; BSID = Bayley Scales of Infant Development; CATCLAMS = cognitive adaptive test/clinical linguistic and auditory milestone scale; DASII = Developmental Assessment Scale of Indian Infants; DMT = Deutscher Motorik Test; GMDS = Griffiths Mental Development Scale; KTT = Kinderturntest; MABC = Movement Assessment Battery for Children; MELS = Mullen Early Learning Scales; PRUNAPE = prueba nacional de pesquisa, a national screening program in Argentinia; RAKIT = Revisie Amsterdamse Kinder Intelligentie Test (Dutch intelligence test); WAIS = Wechsler Adult Scale of Intelligence; WPPSI = Wechsler Prechool and Primary Scale of Intelligence; WISC = Wechsler Infant Scale of Intelligence

[d] Reported median (range) and median (IQR) were recalculated into Mean (SD) using http://www.math.hkbu.edu.hk/~tongt/papers/median2mean.html

[e] Repeated measures are indicated by a "/" in this table.

[f] For all moderator variables a weighted average was calculated and included in meta-regression.

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SAMPLE DESCRIPTION

Seventeen studies reported on a cohort of patients with one single malformation, whereas most studies reported on multiple subgroups of different malformations (30 studies), together resulting in a total of 62 cohorts: esophageal atresia (17 cohorts, n=603 patients), congenital abdominal wall defects (18 cohorts, n=585 patients), followed by colorectal malformations (10 cohorts, n=172 patients), intestinal atresia (5 cohorts, n=131 patients) and intestinal failure (4 cohorts, n=102 patients) and a combination of different congenital malformations (8 cohorts, n=486 patients). Neurodevelopmental outcomes in infants or toddlers (up to 36 months of age) were described in 29 studies (n=1,768 patients), whereas in 21 studies (n=794 patients) neurodevelopmental outcomes of children (up to a maximum age of 13 years) were described. Mean birthweight of patients ranged from 1,980 to 3,492 grams, with 13 studies reporting on cohorts with a mean birthweight < 2500 grams. Mean gestational age of patients ranged from 34 to 39 weeks, with 22 studies reporting on cohorts with a mean gestational age below 37 weeks. The mean proportion of males represented was 55% (ranging from 29% to 80%).

RESULTS OF META-REGRESSION ANALYSES

The following potential moderating factors were assessed in the current meta-analysis: mean age at neurodevelopmental testing, mean gestational age, mean birthweight, sex, comorbidity, growth impairment, neurological complications, age at primary surgery, number of surgeries, number of anesthetic exposures, length of total hospital stay, mean days of mechanical ventilation, mean days of parental nutrition, educational level of parents and socio-economic status of parents.

sTable 2 *Moderating effects of studies' effect sizes of studies' mean age, mean gestational age, mean birthweight and proportion of males on overall neurodevelopmental outcomes, cognitive outcomes and motor outcomes*

	Overall neurodevelopmental outcomes		**Cognitive outcomes**		**Motor outcomes**		Language outcomes[b]
	Number	*Significance*	*Number*	*Statistical*	*Number*	*Statistical*	

	of patients	*effect in meta-regression*	*of patients*	*effect in meta-regression*	*of patients*	*effect in meta-regression*	
Mean age at testing in months	*n*=1182	*p*=0.43	*n*=847	*p*=0.29	*n*=880	*p*=0.94	*NA*
Mean gestational age in weeks	*n*=1260	*p*=0.07	*n*=1155	*p*=0.12	*n*=1014	*p*=0.10	*NA*
Mean birthweight in grams	*n*=1255	*p*=0.08	*n*=1194	*p*=0.07	*n*=1009	*p*=0.45	*NA*
Sex[a]	*n*=790	*p*=0.24	*n*=608	*p*=0.20	*n*=545	*p*=0.45	*NA*
Mean total length of hospital stay in days	*n*=1098	*p*<0.001	*n*=931	*p*=0.24	*n*=817	*p*=0.008	*NA*
Mean number of surgeries	*n*=983	*P*=0.003	*n*=920	*p*=0.04	*n*=834	*p*=0.001	*NA*
a. Sex was expressed as the percentage of male subjects in each cohort b. NA= not asessed							

sTable 3 *Potential moderating factors not assessed in meta-regression*

Author	**Comorbidity**	**Growth**	**Times exposure to anesthesia**	**Age at 1st surgery in days**	**Neurologic complications**	**Feeding**	**Ventilation**	**Parental education**	**Parental SES**
Aite		*n (%) weight <5th percentile*					*Median (range) number of days ventilation*	*n (%) by categories (below high school, high school, degree) by type of parent*	*n (%) by categories (salariate, intermediate, working class, unemployed) by type of parent*
Beers		*n by categories of percentile weight scores (<5th, 5-10th, 10-25th, 25-50th, 75th)*							
Bevilacqua	*n (%) associated malformations (1, more than 1)*							*n (%) by categories (primary school, secondary school, high school, degree) by type of parent*	
Bevilacqua	*n (%) associated malformations (none, 1, more than 1)*		*Median (IQR) by follow-up duration*		*n intracranial hemorraghe*	*n (%) medical appliances for feeding*	*median (IQR) ventilatory time in hours n (%) medical appliances for respiratory*	*n by categories (primary school, secondary school, high school, degree) by type of parent*	*n by categories (class 1-4) by type of parent*
Bouman							*Proportion assisted ventilation*		*Categorial (mid, low, high) by type of parent*
Burnett	*n (%) chromosomal abnormality*	*n (%) small for gestational age at birth (<10th)*		*Median (IQR) in days by ype malformation and age*		*n (%) discharged with tube feeding*		*n (%) low maternal education*	*n (%) receiving government assistence*

Author	**Comorbidity**	**Growth**	**Times exposure to anesthesia**	**Age at 1st surgery in days**	**Neurologic complications**	**Feeding**	**Ventilation**	**Parental education**	**Parental SES**
Chesley					*n with cerebral palsy*	*n with TPN; Median (range) number of days exposed to PN*			
Costerus	*n with comorbidity*			*Median (range) in days*			*Median (range) number of days ventilation*		
Danzer				*Median (range) in days*		*Mean (SD) age at initial feeding*	*Median (range) number of days ventilation*	*n (%) maternal education by categories (none, parttime, fulltime)*	*n (%) maternal education by categories (high school, partly college/college degree, graduate degree)*
Doberschuetz	*n (%) combined malformations*		*Mean (95%CI) duration in hours*	*Mean (95%CI) in hours*	*n with hearing impairment*	*Mean (SD) / median (range) number of days PN, Mean (SD) / Median (range) number of days tube feeding*	*Mean (SD) / median ((range) number of hours ventilation, Mean (SD) / Median (range) number of days oxygen*		*mean score (low, medium, high)*
Elsinga	*n (%) late onset sepsis or BPD*	*median weight*		*Median (range) in days*					
Faugli	*n with associated malformations*					*n (%) with feeding difficulties*	*n (%) assisted ventilation*	*median (range) number of years of maternal education*	

Author	**Comorbidity**	**Growth**	**Times exposure to anesthesia**	**Age at 1st surgery in days**	**Neurologic complications**	**Feeding**	**Ventilation**	**Parental education**	**Parental SES**
Gischler	*n (%) additional medical problems, n (%) septic complications, n (%), median (IQR) number of congenital anomalis*				*n (%) neurologic complications*	*n (%) NG tube at home, n (%) enterostomy at home*	*n (%) tracheostomy, n (%) oxygen at home*		*n (%) by categories (low, middle, high)*
Giudici		*n (%) weight <10th percentile*			*n with cerebral palsy; n with hearing loss*	*Mean (SD) / Median (IQR) number of days PN*	*Mean (Sd) and median (IQR) number of days assisted ventilation*		
Giudici		*n (%) weight <10th percentile*			*n with cerebral palsy; n with hearing loss*	*Mean (SD) / Median (IQR) number of days PN*	*Mean (Sd) and median (IQR) number of days assisted ventilation*		
Gorra									
Harmsen	*n (%) sepsis; n (%) vacterl-association; n (%) cardiac anomaly*		*Median (range) in hours, median (range) number of anesthetic exposures*			*Median (range) number of days PN*	*Median (range) number of days ventilation*		*n (%) by categories (low, middle, high)*
Harris					*n with amblyopia; n with cerebral palsy; n with hearing loss*				

Author	**Comorbidity**	**Growth**	**Times exposure to anesthesia**	**Age at 1st surgery in days**	**Neurologic complications**	**Feeding**	**Ventilation**	**Parental education**	**Parental SES**
Hijkoop	*n (%) multiple congenital anomalies, n (%) complications*	*n (%) SGA at birth*	*Median (IQR) procedures under GA*			*n (%) with intestinal failure; Median (IQR) number of days to full enteral feeding*	*Median (IQR) number of days ventilation by type of malformation*		*median (IQR) maternal SES score, n (%) low maternal SES score*
Huang		*weight for age Z-score per subject*		*age in days per subject*		*Duration of PN in days per subject*			
Kato									
Konig		*n (%) weight for age Z-score < 2*							
Kubota									
Kumari	*n (%) associated congenital anomalies*	*n (%) -3SD weight for age*					*n (%) on mechanical ventilation*	*n (%) graduated mothers*	*n (%) homemakers and monthly family income*
Laing				*Median (IQR) in days*	*n (%) with microcephaly*		*Median (IQR) hours assisted ventilation*	*n (%) by categories (<12y schooling, >12y, tertiary or further, bachelor or higher degree) by type of parent*	n (%) occupation father (skilled, unskilled, associate professional, professional)
Ludman							*n (%) assisted ventilation >4 days*		*n (%) by categories (manual, non-manual, single mom)*
Ludman									
Maheswari									

Author	**Comorbidity**	**Growth**	**Times exposure to anesthesia**	**Age at 1st surgery in days**	**Neurologic complications**	**Feeding**	**Ventilation**	**Parental education**	**Parental SES**
Mawlana	*n (%) VACTERL, n (%) associated anomalies, n (%) chromosomal anomalies*	*n (%) weight <10th percentile*				*n (%) with gastrostomy*			
Mazer	*Median (IQR) number of congenital anomalies, n (%) syndromal / chromosomal abnormality*					*Median (IQR) medical appliances (O2 or tracheostomy) at discharge*	*Median (IQR) medical appliances (NG tube or enterostomy) at discharge*		
Minutillo									
Moran					*MRI abnormalities*			*n (%) maternal tertiairy education*	*n (%) higher social risk*
More				*Median (IQR) age in days*					
Newton							*Mean days on ventilator*		
Payne		*% weight <10th percentile*				*n (%) all per oris feeding at discharge*	*Mean (SD) ventilator days*		*n (%) single mother*
Plummer		*weight for age z score*				*Median (IQR) number of days PN; Percentage PN <>7days; Percentage gastrostomy*	*Median (IQR) days of assisted ventilation; Percentage >2 days assisted ventilation*	*n (%) maternal eductation (college or higher)*	
Sirichaipornsak									

Author	**Comorbidity**	**Growth**	**Times exposure to anesthesia**	**Age at 1st surgery in days**	**Neurologic complications**	**Feeding**	**Ventilation**	**Parental education**	**Parental SES**
So					*n with cerebral palsy*	*Median (IQR) number of days PN first year; Percentage patients 100% full enteral feeding first year*			
So		*weight for age Z-score*			*n with microcephaly*	*Median (IQR) number of days PN; % PN dependance at follow-up; % enterostomy*			
So					*n with CNS comorbidity; n with cerebral palsy; n with hearing loss; n with visual comorbidity*	*Median (IQR) number of days PN first year/ first two years; n (%) PN at follow-up of two years; n (%) 100% full enteral feeds at follow-up of two years*			
South		*% weight <10th percentile*			*n (%) abnormal neurological exam*	*Mean (SD) number of days to full enteral feedings; mean (sd) number of days PN*	*Mean (SD) number of days assisted ventilation*		

Author	**Comorbidity**	**Growth**	**Times exposure to anesthesia**	**Age at 1st surgery in days**	**Neurologic complications**	**Feeding**	**Ventilation**	**Parental education**	**Parental SES**
Van den Hondel 2013	*n (%) at least 1 major associated anomaly; n with suspected (not diagnosed) syndrome*	*n (%) Small for gestational age at birth*				*n (%) gastrostomy*			
Van den Hondel	*n (%) major comorbidity present*		*Median (IQR) by type of malformation; Median (IQR) by follow-up duration*						*n (%) by categories (low, middle, high) by type of malformation*
Van der Cammen-van Zijp	*n (%) associated malformations*	*n (%) Small for gestational age at birth*					*Median (range) days ventilation support, n (%) ECMO*		
Van Eijck	*n with congenital tethered spinal cord syndrome*								
Walker	*n (%) of associated malformations*								
Walker									
Reason for exclusion from univariate meta regression	***Heterogeneity of definitions***	***Heterogeneity of definitions***	***Not enough studies***	***Not enough studies***	***Heterogeneity of definitions***	***Too biased by type of malformation***	***Too biased by type of malformation***	***Heterogeneity of definitions***	***Heterogeneity of definitions***

RESULTS OF SUBGROUP ANALYSES ON TYPE OF MALFORMATION

Motor outcomes were significantly different across subgroups of malformations (Q=11.704, p=0.020). Cognitive (Q=3.798, p=0.434) and language outcomes (Q=0.589, p=0.745) did not significantly differ across different types of malformations.

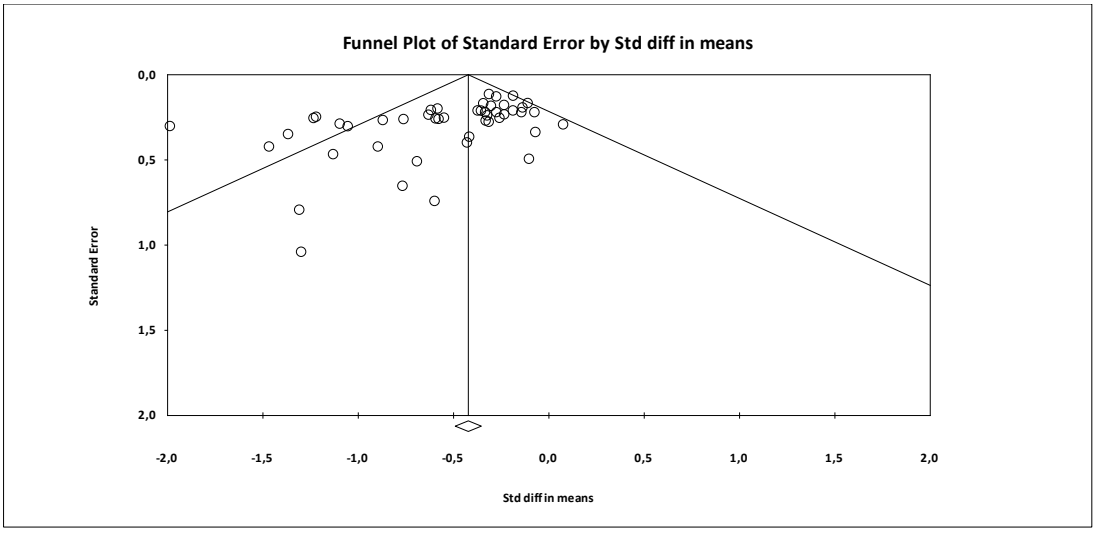
Further analyses showed that patients with short bowel syndrome had significantly worse motor outcomes compared to all remaining patient groups (d=-1.062 and d=-0.474, Q=7.682; p=0.006), but comparable cognitive outcomes (d=-0.241 and d=-0.432,Q=2.875; p=0.09) and language outcomes (d=-0.692 and d=-0.598, Q=0.038; p=0.85).

RESULTS OF SENSITIVITY ANALYSIS OF STUDIES OF GOOD QUALITY

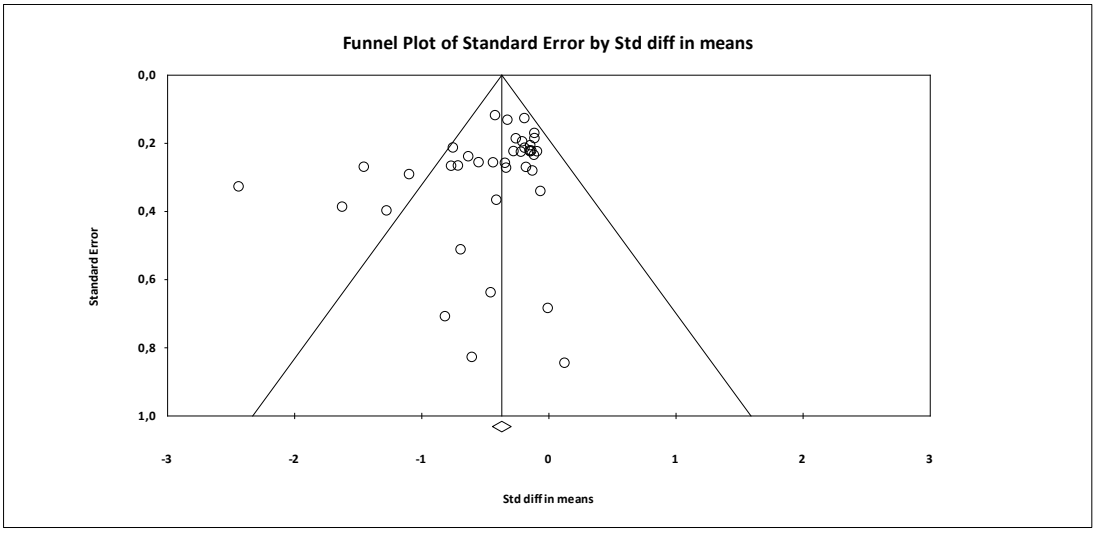
Effect sizes for overall neurocognitive outcomes and cognitive outcomes differed between studies of different quality ratings (Q=21.46, p<0.001 and Q=45.53, p<0.001, respectively). Sensitivity analysis on studies of good quality (n=36), showed that the reported meta-analytic findings (impairments) were replicated for overall neurodevelopmental outcomes (d=-0.371,95%CI: -0.462 – 0.280, p<0.001), cognitive outcomes (d=-0.281, 95%CI: -0.363 - -0.199, p<0.001), motor outcomes (d=-.0568, 95%CI: -0.738 - -0.398, p<0.001) and language outcomes (d=-0.570, 95%CI: -0.865 - -0.274, p<0.001).

RISK OF BIAS ANALYSIS

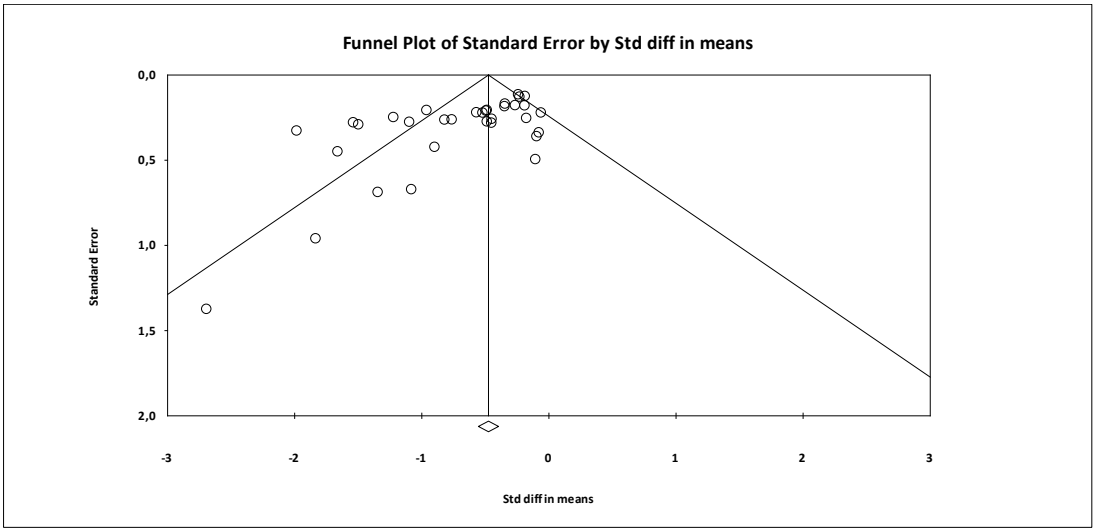
sFigure1 *Funnelplot of overall neurodevelopmental outcomes*



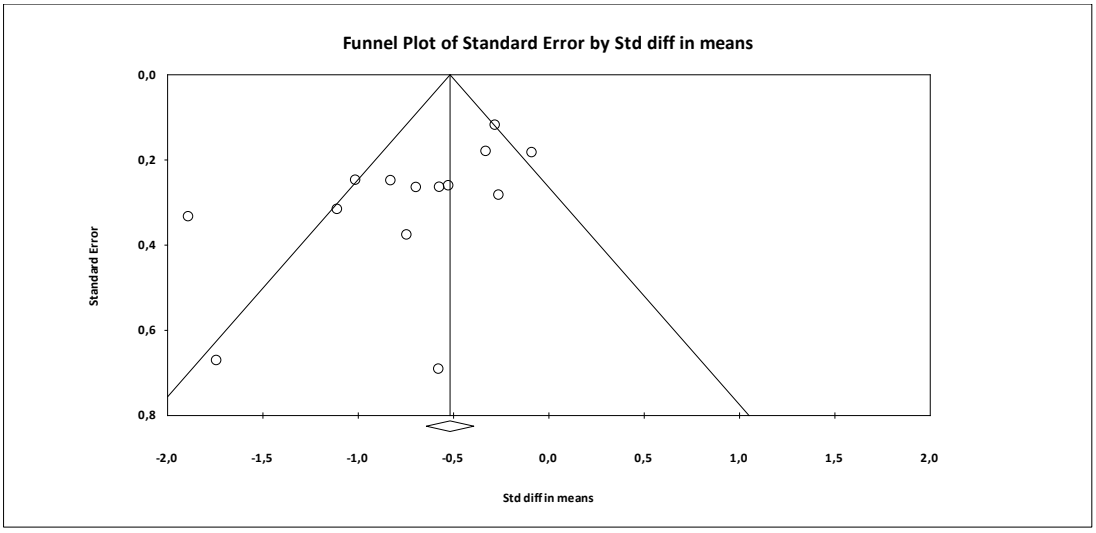
sFigure2 *Funnelplot of cognitive outcomes*



sFigure 3 *Funnelplot of motor outcomes*



sFigure4 *Funnelplot of language outcomes*



All funnel plots were symmetric on visual inspection and showed no asymmetry. However, Egger's regression showed significant risk of publication bias for all meta-analyses. Risk of potential assessment bias was found for (a) 39 of the 47 studies because these studies compared patient data with normative data standardized for age only, leaving other potentially confounding factors uncontrolled, and (b) 22 of the 47 studies because of loss to follow-up of more than 70% of the participants which may lead to a potential bias either due to loss of high-functioning patients or due to loss of severely impaired patients with co-morbidity and subsequent higher mortality.

PRISMA CHECKLIST

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2-3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	N/A. The study protocol can be provided by authors.
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5-6, see Search and Selection
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5, see Search and Selection
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary Material.
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	5, see Search and Selection
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6-7, see Data-extraction
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6-7, see Data-extraction
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how	7-8 - See Quality assessment

		this information is to be used in any data synthesis.	and Statistics
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	7, See Statistics: Cohen's d
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	7-8, see Statistics: - I^2 - Random-effects meta-analysis
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	7-8, see Statistics: - Visual inspection funneplots - Eggers intercept
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	7-8, see Statistics: Sensitivity analysis were done to compare outcomes at different domains of neurodevelopment, to compare different types of malformations and to compare evidence of different study quality.
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	5-6, see Search and Selection; Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Supplementary Table, sTable 1
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Table 2
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Figure 2 / Table 2
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	9-11, described in results section, Table 2
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	12-13
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	11-15, Supplementary Table sTable 2
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	16-17, summary of findings was given in the first part of the discussion

Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	18, limitations were discussed under "limitations"
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	18, see Conclusions
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	N/A