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► **To cite this version:**

Adrien M Aubert, Raquel Costa, Ulrika Ådén, Marina Cuttini, Mairi Männamaa, et al.. Movement Difficulties at Age Five Among Extremely Preterm Infants. *Pediatrics*, 2022, 149 (6), pp.e2021054920. 10.1542/peds.2021-054920 . inserm-04459253

HAL Id: inserm-04459253

<https://inserm.hal.science/inserm-04459253v1>

Submitted on 15 Feb 2024

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1 **Movement Difficulties at Age Five among Extremely Preterm Infants**

2
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30 31 Short title:

32 Preterm Birth and Movement Difficulties

33 34 Conflict of Interest Disclosures:

35 The authors have no conflicts of interest relevant to this article to disclose.

36 37 Funding/Support:

38 Funding received from the European Union: Seventh Framework Programme (FP7/2007-2013)
39 under grant agreement No 259882; and Horizon 2020 Research and Innovation Program under
40 grant agreement No 633724 and No 733280.

41 42 Role of Funder/Sponsor:

43 The funder/sponsor did not participate in the work.

44 45 Abbreviations:

46 BPD, bronchopulmonary dysplasia

47 CI, confidence interval

48 CP, cerebral palsy

49 cPVL, cystic periventricular leukomalacia

50 EPICE, Effective Perinatal Intensive Care in Europe

51 EPT, extremely preterm
52 GA, gestational age
53 IPW, inverse probability weighting
54 IQ, intelligence quotient
55 IVH, intraventricular haemorrhage
56 Movement ABC, Movement Assessment Battery for Children (1st Edition)
57 Movement ABC-2, Movement Assessment Battery for Children (2nd Edition)
58 RRR, relative risk ratio
59 SD, standard deviation
60 SGA, small for gestational age
61 SHIPS, Screening to Improve Health in Very Preterm Infants in Europe
62

63 Article Summary:

64 This study estimates the prevalence of movement difficulties among five-year-old children born
65 extremely preterm and identifies associated sociodemographic, perinatal and neonatal risk
66 factors.

67

68 What's Known on This Subject:

69 Movement difficulties are common among children born extremely preterm, but prevalence
70 varies widely between studies. Male sex and gestational age seem to be the only two factors
71 consistently associated with movement difficulties following extremely preterm birth.

72

73 What This Study Adds:

74 In a large European cohort of children born extremely preterm, this study confirms a very high
75 prevalence of movement difficulties and identifies multiple perinatal, neonatal and
76 sociodemographic risk factors for poor motor function at five years of age.

77 **Contributors' Statement:**

78 Aubert, Costa and Zeitlin conceptualized and designed the study, carried out the different
79 analyses, drafted the initial manuscript, and reviewed and revised the manuscript.

80 Ådén and Johnson supervised the different analyses, and critically reviewed and revised the
81 manuscript for important intellectual content.

82 Cuttini, Männamaa, Pierrat, Sarrechia, van Heijst and Zemlin contributed to the study design,
83 participated in data collection and curation and critically reviewed and revised the manuscript
84 for important intellectual content.

85 All authors approved the final manuscript as submitted and agree to be accountable for all
86 aspects of the work.

87 **Abstract**

88 **Background and Objectives**

89 Children born extremely preterm (EPT, <28 weeks' gestational age (GA)) face higher risks of
90 movement difficulties than their term-born peers, but prevalence varies greatly between studies.
91 Further, results on prognostic factors to identify children who could benefit from early
92 intervention have been inconsistent. This study investigated the prevalence of movement
93 difficulties in children born EPT and associated risk factors.

94

95 **Methods**

96 We used data from a population-based EPT birth cohort in 11 European countries in 2011-2012.
97 772 children without cerebral palsy (CP) were assessed at five years of age with the Movement
98 Assessment Battery for Children – 2nd Edition which classifies movement difficulties into three
99 categories: none (>15th percentile), at risk (6th-15th percentile) and significant (≤5th percentile).
100 Associations with sociodemographic, perinatal and neonatal characteristics, collected from
101 obstetric and neonatal medical records and parental questionnaires, were estimated using
102 multinomial logistic regression.

103

104 **Results**

105 23.2% (n=179) of children were at risk of movement difficulties and 31.7% (n=244) had
106 significant movement difficulties. Lower GA, severe brain lesions, and receipt of postnatal
107 corticosteroids were associated with significant movement difficulties, while male sex and
108 bronchopulmonary dysplasia were associated with being at risk and having significant
109 movement difficulties. Children with younger, primiparous, less educated and non-European-
110 born mothers were more likely to have significant movement difficulties. Differences in
111 prevalence between countries remained after population case-mix adjustments.

112

113 **Conclusion**

114 This study confirms a high prevalence of movement difficulties among EPT children without
115 CP which are associated with perinatal and neonatal risk factors as well as sociodemographic
116 characteristics and country.

117 **Introduction**

118 With advances in obstetric and neonatal care, the survival of children born extremely
119 preterm (EPT, <28 weeks' gestational age (GA)) has increased in recent decades.¹⁻³ These
120 children face higher risks of long-term developmental problems than children born at term,
121 including cerebral palsy (CP) and a wide range of motor, sensory, cognitive and behavioural
122 impairments.⁴⁻⁶ In contrast with declining mortality and CP among EPT children, the
123 prevalence of other neurodevelopmental impairments appears to have remained stable over time
124 or potentially increased.^{7,8} The lack of progress in developmental outcomes, accompanied by
125 increasing numbers of survivors, makes research on the consequences of EPT birth a priority
126 to enable early identification of developmental difficulties and timely referral for intervention
127 at the individual and population levels.⁹

128 Movement difficulties are a common consequence of EPT birth.^{7,10-13} Movement
129 difficulties can reduce the child's opportunities to develop in other areas and have been
130 associated with impaired cognitive development, school performance, social integration, and
131 functioning in adulthood.^{4,5,10,14-18} Despite this growing evidence base on the consequences of
132 movement difficulties, our understanding of its prevalence and risk factors remains limited,^{12,19}
133 particularly among children without CP.^{7,13,20} For instance, the prevalence of movement
134 difficulties varies greatly between studies from 8%²¹ to more than 40%^{13,18,20,22} likely due to
135 population inclusion criteria, such as GA and birthweight thresholds, and methodological
136 differences. Recent reviews found inconsistent results in relation to early life risk factors with
137 consistent associations with motor impairment among children free of major disability only for
138 male sex and preterm birth.^{6,12}

139 Reviews on motor function among children born very preterm^{4,12,23} have pointed to the
140 lack of studies reporting the development of these children at school age, the lack of
141 standardization of the measurement tools, the small and heterogeneous samples, as well as the

142 failure to take into account different clinical and sociodemographic characteristics which can
143 strongly influence the results. Using data from a population-based European cohort of EPT
144 children assessed using the Movement Assessment Battery for
145 Children – 2nd Edition (Movement ABC-2),²⁴ this study aimed to estimate the prevalence of
146 movement difficulties among five-year-old children born EPT without CP in 19 regions from
147 11 European countries and to identify sociodemographic, perinatal and neonatal risk factors
148 associated with movement difficulties.

149

150 **Methods**

151 *Study Design and Participants*

152 We used data from the Screening to Improve Health in Very Preterm Infants in Europe (SHIPS)
153 study which followed-up the Effective Perinatal Intensive Care in Europe (EPICE) population-
154 based, prospective cohort of children born before 32 weeks of GA, in 2011-2012, in 19 regions
155 in 11 European countries.²⁵ Data were collected from obstetrical and neonatal records during
156 the neonatal hospitalization using a standardized, pretested instrument by study investigators or
157 medical personnel. When the child was two and five years of age, questionnaires on health,
158 general development and socioeconomic circumstances were sent to parents. Clinical
159 assessments, evaluating neurocognitive functioning and motor skills (using the Movement
160 ABC-2) were also carried out at five years of age for children born EPT.

161 Our study population was limited to children born EPT who were eligible for the
162 Movement ABC-2 assessment. Out of 1,671 EPT infants alive at discharge (**Figure 1**), 1,654
163 were alive at five years and 1,021 were followed-up. As in most studies using the
164 Movement ABC-2, we excluded children with a CP diagnosis (n=98),²⁶⁻²⁸ as this is a well-
165 defined neurodevelopmental disorder,²⁹ as well as children with a severe neurodevelopmental

166 impairment defined as an intelligence quotient (IQ) ≤ 54 ($< -3SD$) or severe hearing or visual
167 impairment (n=32) because the Movement ABC-2 was not designed to assess movement
168 abilities in these children.²⁴ Lastly, we excluded children with missing Movement ABC-2 data
169 (n=119): 88 children were assessed by parental questionnaire only, while in 31 the test was
170 incomplete or missing and imputation was not possible. The final sample comprised
171 772 children.

172

173 *Movement difficulties*

174 The Movement ABC-2,²⁴ is a validated test to evaluate movement difficulties by age
175 category,^{10,30} even in high-risk populations of EPT children.²⁷ It assesses performance on eight
176 motor tasks in three motor components: manual dexterity, aiming and catching, and balance.
177 Scores from all tests were summed and converted to an age adjusted percentile score based on
178 United Kingdom norms which classify movement difficulties into three categories: none ($>15^{\text{th}}$
179 percentile), at risk (6-15th percentile), and significant ($\leq 5^{\text{th}}$ percentile), within each component
180 and globally.²⁴ As national norms exist only in Belgium, France, Italy, the Netherlands and the
181 United Kingdom,^{24,31-33} we uniformly applied the United Kingdom norms which are the most
182 commonly used in the literature.^{24,34} The Movement ABC-2 was administered by trained
183 psychologists or physiotherapists. Assessments were carried out by staff in local routine follow-
184 up programs where available (Belgium, the Netherlands, Sweden) or by the SHIPS research
185 team (Denmark, Estonia, France, Germany, Italy, Poland, Portugal, the United Kingdom).
186 While it was not possible to carry out inter-rater reliability across countries, common data
187 collection guidelines and a core data collection form were developed to standardize procedures
188 and to ensure consistent reporting of the assessment results. Training sessions were held locally
189 and an online discussion forum was set up to discuss possible problems emerging during the
190 data collection.

191 Children who had missing Movement ABC-2 data were reviewed on a case-by-case
192 basis by neurodevelopmental specialists and an epidemiologist (RC, UA, SJ, JZ). If a child was
193 unable to complete a test-item or component because of severe motor impairment, the lowest
194 score was assigned for that test-item and/or component (n=7). If data were missing for a test-
195 item/component score in the absence of other developmental problems, the average of the other
196 test-items within the component was used for imputation (n=11). For 11 Belgian children,
197 percentile scores from the Movement ABC (1st Edition) were used.³⁵ In all other cases, scores
198 were left as missing.

199

200 *Risk factors*

201 Variables selected for this analysis were those hypothesized to affect risks of movement
202 difficulties based on biological plausibility and the scientific literature. Sociodemographic
203 factors included maternal age at childbirth, parity and maternal country of birth (from neonatal
204 records) and parental cohabiting status, maternal educational level³⁶ and household
205 unemployment status (from parental questionnaires). Perinatal and neonatal factors were GA,
206 small for GA (SGA),³⁷ sex, multiple birth, premature rupture of membranes >12 hours, any
207 antenatal corticosteroids, congenital anomaly,³⁸ severe brain lesions (intraventricular
208 haemorrhage (IVH) grade III/IV or cystic periventricular leukomalacia (cPVL)), retinopathy of
209 prematurity stage III or more, necrotizing enterocolitis (requiring surgery or peritoneal
210 drainage), bronchopulmonary dysplasia (BPD, defined as supplemental oxygen at 36 weeks'
211 postmenstrual age), postnatal corticosteroids³⁹ and breastfeeding at discharge.

212

213 *Statistical analyses*

214 We first described the characteristics of children included in the sample and those excluded
215 because of missing Movement ABC-2 scores. We then described the Movement ABC-2
216 classifications overall and by component. We produced three models to measure the association
217 of sociodemographic, perinatal and neonatal variables with the probability of being at risk or
218 having significant movement difficulties using multinomial logistic regression taking into
219 consideration clustering within multiple pairs: (1) with no adjustment except country modelled
220 as a fixed effect (termed “unadjusted”); (2) adjusted on sociodemographic and perinatal factors,
221 and (3) with additional adjustments on neonatal factors.

222 To take into account loss to follow-up, we used inverse probability weighting (IPW).^{40,41}
223 As described previously for this cohort,^{42–44} we compared the characteristics of responders and
224 non-responders at the five-year follow-up (**Supplemental Table 1**). Variables potentially
225 affecting loss to follow-up were used to estimate the probability of response using multivariate
226 logistic regression and to define a weight inversely proportional to this probability
227 (**Supplemental Table 2**). Multiple imputation by chained equations was used (m=20) to impute
228 missing data for covariates used to create the weights.^{45,46} We also imputed data for covariates
229 in the final models (m=20). Three had a percentage of missing >3.0%: household
230 unemployment status (6.7%), parental cohabiting status (5.8%), and maternal education (4.0%).
231 Data were assumed to be missing at random after taking into consideration observed covariates.
232 We did not impute data for children with missing Movement ABC-2 scores as the missing at
233 random assumptions likely did not hold. However, we compared the characteristics of children
234 with and without Movement ABC-2 scores. Final models used IPW and multiple imputation.⁴⁷

235 We carried out sensitivity analyses by rerunning models (1) using the unweighted and
236 complete case samples and (2) using national norms in the countries where these were available,
237 as these may affect movement difficulties classification.³⁴

238 All analyses used the statistical software Stata version 15.0 (StataCorp, College Station,
239 TX, USA).

240

241 **Results**

242 Children in the study sample were assessed at 5.7 (0.4) years (mean (SD)) (**Table 1**). 28.6%
243 were born <26 weeks of GA, 49.8% were males and 71.9% were singletons. Their mothers
244 were aged 35 years or older for 26.1%, 58.5% were primiparous, 37.0% had at least a bachelor's
245 degree and 18.6% were born outside of Europe. Compared to children in the sample, those
246 without Movement ABC-2 scores were less likely to have young (<25 years) or old (≥ 35 years)
247 mothers and were more likely to have lower GA and to not be breastfed at discharge from the
248 neonatal unit. For children followed at two years of age, missing Movement ABC-2 scores were
249 more common among those with impairment. Loss to follow-up was mainly related to social
250 disadvantage and GA (**Supplemental Table 1**).

251

252 ***Movement difficulties among EPT children***

253 23.2%, and 31.7% of the children were classified at risk and with significant movement
254 difficulties, respectively (**Table 2**). The prevalence of significant movement difficulties was
255 higher for the manual dexterity component (37.4%), than the aiming and catching and balance
256 components (19.2% and 19.7%, respectively).

257

258 ***Risk factors associated with movement difficulties***

259 The prevalence of movement difficulties by risk factor group as well as unadjusted relative risk
260 ratios and their 95% confidence intervals (RRR [95% CI]) are presented in **Table 3**. Some
261 factors had strong associations with both being at risk of movement difficulties and having

262 significant movement difficulties (i.e., household unemployment status, SGA, male sex,
263 retinopathy of prematurity, and BPD), while some others were associated with
264 significant movement difficulties only (i.e., congenital anomalies, severe brain lesions,
265 postnatal corticosteroids). Prevalence of significant movement difficulties ranged from 12.4%
266 (The Netherlands) to 72.3% (Poland), whereas the at risk group ranged from 11.3% (Sweden)
267 to 39.0% (Belgium).

268

269 Adjustment on sociodemographic and perinatal factors (model I) slightly attenuated
270 these associations (**Table 4**). Adjusting for neonatal factors (model II) further reduced the
271 magnitude of associations of low GA, SGA, male sex and congenital anomalies with
272 significant movement difficulties. Severe brain lesions and postnatal corticosteroids were risk
273 factors for significant movement difficulties whereas BPD were risk factors for both at risk and
274 significant movement difficulty groups. The other morbidities were no longer significant. These
275 adjustments did not strongly impact on the estimated associations with sociodemographic
276 factors. The large differences between countries persisted in adjusted models.

277

278 Sensitivity analyses without IPW did not show differences in sample characteristics or
279 prevalence of movement difficulties (**Supplemental Tables 3 and 4**), and final models using
280 the unweighted and complete case samples yielded similar conclusions (**Supplemental Table**
281 **5**). Redoing models using Movement ABC-2 national norms (**Supplemental Table 6**) gave
282 broadly similar results and did not affect study conclusions about the key risk factors or the
283 wide variation between countries, although country rankings changed.

284

285 **Discussion**

286 Among 772 European children born EPT without CP or severe neurodevelopmental
287 impairment, 23.2% and 31.7% were classified as being at risk and having significant movement
288 difficulties, respectively. Children with lower GA, severe brain lesions, and who received
289 postnatal corticosteroids were more likely to have significant movement difficulties, whereas
290 SGA (i.e., <3rd percentile), male sex and BPD were associated with both being at risk and
291 having significant movement difficulties. Sociodemographic factors, including having
292 younger, primiparous, less educated and non-European born mothers, were associated with
293 movement difficulties risks. Wide variations in prevalence existed by country and these
294 persisted after adjustment for individual characteristics.

295

296 *Prevalence of movement difficulties*

297 While children born EPT are more likely to have movement difficulties compared to their term-
298 born peers,^{6,10,20,48} prevalence estimates reported in the literature vary by a factor of five.^{13,18,20-}
299 ²² Some of this variability results from the use of different motor function measures
300 including parental report,⁴⁹ Movement ABC, or other tests,^{6,10,12} ages of assessment and
301 population inclusion criteria.²⁰ When comparisons are restricted to studies with samples and
302 methods similar to ours, prevalence is higher with lower variability. For instance, 37.1% of
303 children had Movement ABC-2 scores \leq 5th percentile in a Swedish sample born <27 weeks'
304 GA, after exclusion of children with CP or severe neurodevelopmental impairment.¹³ In an
305 Australian sample of 165 children born <30 weeks' GA or <1250 g birthweight without CP or
306 IQ <80 points, 47.9% had a Movement ABC (1st Edition) score \leq 16th percentile.¹⁸ Nonetheless,
307 contextual variations in prevalence persist even between these more standardized samples, as
308 we observed within our European cohort by the differences between countries. Variation is also
309 seen in proportions classified as being at risk or with significant movement difficulties, with

310 some studies finding more children in the most severe category,⁵⁰ as we did. This heavily
311 skewed distribution of scores reflects the high levels of impairment in this population. Finally,
312 when movement difficulties were classified by component, we noted a lower prevalence of
313 impairment for aiming and catching and balance (19-20% with significant movement
314 difficulties) compared to manual dexterity (37%). Two previous reviews also noted differences
315 by domain, with lower performance in manual dexterity in some, but not all studies.^{10,50}

316

317 ***Risk factors***

318 Some perinatal and neonatal characteristics associated with movement difficulties were
319 reported previously,^{6,12,50} including lower GA, SGA, male sex, severe brain lesions, BPD and
320 postnatal corticosteroids.^{27,51} In a recent review, Van Hoorn et al.,⁶ reported on several studies
321 showing associations between neonatal brain lesions and motor development and use of
322 postnatal corticosteroids was associated with motor impairment in two out of three studies. The
323 risk of developmental coordination disorder (measured by Movement ABC in 22/36 studies),
324 was generally inversely related to GA group, an association found in our sample. Contrary to
325 some reports, premature rupture of membranes, necrotizing enterocolitis and retinopathy of
326 prematurity were not associated with movement difficulties.⁵¹⁻⁵³ However, these associations
327 have been inconsistent in the literature^{6,12} and may be influenced by population differences
328 (e.g., inclusion of children with other major disabilities),⁵² or methods for measuring
329 comorbidities.⁵¹ Finally, we found that children who did not receive antenatal corticosteroids
330 were less likely to be at risk of movement difficulties, an association not previously reported;⁶
331 however, as few children were in this group, this may be a spurious finding. Being able to
332 identify children at risk using perinatal and neonatal risk profiles has the potential to improve
333 long-term motor outcomes as studies find beneficial effects of early intervention.^{54,55} Further,
334 the identification of risk factors can generate etiological hypotheses; our finding that risk

335 profiles differed for children classified as at risk versus with significant movement difficulties,
336 requiring confirmation in future work, may suggest varying causal pathways.

337

338 Several sociodemographic characteristics increased risks of movement difficulties: low
339 maternal age, lower educational level, parental unemployment, primiparity, and non-European
340 maternal country of birth. Previous studies have reported associations with some
341 sociodemographic characteristics, but often only one or two characteristics and among younger
342 children below five years of age.^{12,56-59} Null or contradictory findings may result from
343 sociodemographic factors not being consistently or fully explored.^{6,12,50} Understanding how
344 social factors interact with medical and biological risk is an important area for study since it
345 makes it possible to target at-risk groups and understand risk and resilience mechanisms.

346

347 After adjustment on sociodemographic and clinical factors, differences in movement
348 difficulties persisted by country of birth. We also found that prevalence estimates at the country-
349 level were sensitive to the choice of norm, as previously shown.³⁴ Taken together, these results
350 raise the possibility that cultural or policy factors could affect motor outcomes for children born
351 EPT. For instance, pre-school, school or public health programmes which differ between
352 European countries,⁶⁰⁻⁶² may influence general motor development and subsequently affect
353 performance on Movement ABC tests, even for children born EPT.⁶³⁻⁶⁵ Further research to
354 confirm and investigate cross-country differences in movement difficulties could inform
355 prevention efforts.

356

357 ***Strengths and limitations***

358 The main strengths of this study are its large, population-based sample of >750 EPT children,
359 standardised collection of sociodemographic, perinatal and neonatal data and the measurement

360 of movement difficulties using a validated and widely used clinical assessment.^{10,12} Few studies
361 have been carried out on prognostic factors for motor impairment in EPT children without CP
362 and most studies of Movement ABC-2 have much smaller samples.¹² To harmonise results
363 between countries, we applied the Movement ABC-2 United Kingdom norms²⁴ and were able
364 to carry out sensitivity analyses to confirm that risk factor results were robust to use of national
365 norms. An additional strength is that we analysed children at risk of movement difficulties as
366 well as those with significant movement difficulties. Minor difficulties are less often examined,
367 but they may substantially impact quality of life and have been identified as an important
368 priority for future investigation.⁹

369

370 Limits include possible attrition bias due to loss to follow-up (61.7% follow-up at 5
371 years) or bias due to children with a missing Movement ABC-2 score. Because we have full
372 data on the cohort at inclusion, these biases could be described and we were able to use IPW to
373 adjust for loss to follow-up, principally related to social factors, as found in other cohorts.⁴²⁻⁴⁴
374 In contrast, we did not use statistical methods to adjust for bias due to missing Movement ABC-
375 2 scores. These children were a higher risk sub-group and their Movement ABC-2 assessments
376 were likely not missing at random. This may lead to underestimation of movement difficulties
377 in this population. Further, we found large differences in movement difficulties prevalence
378 between countries, but could not explore them in more detail because of limited sample sizes
379 per country. We did not have a control population of children born at term, however studies
380 with controls report good calibration of Movement ABC-2 norms in their control samples.⁵⁰
381 While test and examiner reliabilities across sites were not assessed, recommendations by the
382 European Academy of Childhood Disability on developmental coordination disorder concluded
383 that the Movement ABC-2 has good to excellent inter-rater reliability and test-retest
384 reliability.¹⁷ A final limitation is the study's observational design and the measurement of some

385 sociodemographic characteristics at the same time as our study outcome. However, our
386 objective was to identify risk-factor associations, not determine causality.⁶⁶

387

388 **Conclusion**

389 In this large population-based sample of five-year-old children born EPT in Europe without CP,
390 we found that over half were at risk of movement difficulties or had significant movement
391 difficulties. We identified multiple clinical risk factors which could be used to prioritise at-risk
392 children for follow-up and early intervention services. We also showed associations with social
393 factors illustrating the importance of integrating social circumstances into public health
394 programmes for children born EPT. Finally, our study found unexplained variability in the
395 prevalence of at risk of/significant movement difficulties by country that raise questions about
396 the role of the broader social or health context in mitigating risks in this population.

397 **Supplemental tables:**

398 **1/ Supplemental table S1.** Characteristics of children followed and lost to follow-up at 5 years
399 of age (without IPW).

400 **2/ Supplemental table S2.** List of the variables included in the multiple imputation by chained
401 equations and IPW programs.

402 **3/ Supplemental table S3.** Characteristics of children included in the study and comparison
403 with children who had missing Movement ABC-2 scores - Sensitivity analysis without IPW.

404 **4/ Supplemental table S4.** Rates of movement difficulties, in total and by component (based
405 on Movement ABC-2) – Sensitivity analysis without IPW.

406 **5/ Supplemental table S5.** Association between movement difficulties and sociodemographic,
407 perinatal and neonatal characteristics (Model II) among five-year-old children born extremely
408 preterm – Sensitivity analysis in complete case without IPW, complete case with IPW, and
409 multiple imputed dataset without IPW.

410 **6/ Supplemental table S6.** Association between movement difficulties and sociodemographic,
411 perinatal and neonatal characteristics (Model II) among five-year-old children born extremely
412 preterm – Sensitivity analysis with the use of Movement ABC-2 United Kingdom norms vs
413 Movement ABC-2 national norms.

414

415 **Supplementary materials:**

416 **Ethical approval:**

417 All study regions obtained ethical approval according to national legislations. The study was
418 also approved by the French Advisory Committee on Use of Health Data in Medical Research
419 (CCTIRS) and the French National Commission for Data Protection and Liberties (CNIL).
420 Parents gave their written informed consent to participating in the study prior to any data
421 collection.

422

423 **Acknowledgements:**

424 Additional funding is acknowledged from the following regions: France (French Institute of
425 Public Health Research/Institute of Public Health and its partners the French Health Ministry,
426 the National Institute of Health and Medical Research, the National Institute of Cancer and the
427 National Solidarity Fund for Autonomy; grant ANR-11-EQPX-0038 from the National
428 Research Agency through the French Equipex Program of Investments in the Future and the
429 PremUp Foundation); United Kingdom (funding for The Neonatal Survey from Neonatal
430 Networks for East Midlands and Yorkshire and the Humber regions).

431 ***SHIPS Research group:** Belgium (J Lebeer, I Sarrechia, P Van Reempts, E Bruneel, E Cloet,
432 A Oostra, E Ortibus); Denmark (K Boerch, P Pedersen); Estonia (L Toome, H Varendi, M
433 Männamaa); France (PY Ancel, A Burguet, PH Jarreau, V Pierrat, A Nuytten); Germany (RF
434 Maier, M Zemlin, B Misselwitz, L Wohlers) Italy (M Cuttini, I Croci, V Carnielli, G Ancora,
435 G Faldella, F Ferrari); The Netherlands (A van Heijst, C Koopman-Esseboom); Poland (J
436 Gadzinowski, J Mazela, A Montgomery, T Piłkuła) Portugal (H Barros, R Costa, C Rodrigues);
437 Sweden (U Aden); United Kingdom (ES Draper, A Fenton, SJ Johnson); EFCNI (S Mader, N
438 Thiele, JM Pfeil); Health Economics team (S Petrou, SW Kim, L Andronis); Inserm
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References:

1. Tucker J, McGuire W. Epidemiology of preterm birth. *BMJ*. 2004;329(7467):675-678. doi:10.1136/bmj.329.7467.675
2. Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. *Lancet Lond Engl*. 2008;371(9606):75-84. doi:10.1016/S0140-6736(08)60074-4
3. Stoll BJ, Hansen NI, Bell EF, et al. Trends in Care Practices, Morbidity, and Mortality of Extremely Preterm Neonates, 1993-2012. *JAMA*. 2015;314(10):1039-1051. doi:10.1001/jama.2015.10244
4. Moreira RS, Magalhães LC, Alves CRL. Effect of preterm birth on motor development, behavior, and school performance of school-age children: a systematic review. *J Pediatr (Rio J)*. 2014;90(2):119-134. doi:10.1016/j.jped.2013.05.010
5. Allotey J, Zamora J, Cheong-See F, et al. Cognitive, motor, behavioural and academic performances of children born preterm: a meta-analysis and systematic review involving 64 061 children. *BJOG Int J Obstet Gynaecol*. 2018;125(1):16-25. doi:https://doi.org/10.1111/1471-0528.14832
6. van Hoorn JF, Schoemaker MM, Stuive I, et al. Risk factors in early life for developmental coordination disorder: a scoping review. *Dev Med Child Neurol*. 2021;63(5):511-519. doi:10.1111/dmcn.14781
7. Spittle AJ, Cameron K, Doyle LW, Cheong JL, Victorian Infant Collaborative Study Group. Motor Impairment Trends in Extremely Preterm Children: 1991-2005. *Pediatrics*. 2018;141(4). doi:10.1542/peds.2017-3410
8. Cheong JLY, Olsen JE, Lee KJ, et al. Temporal Trends in Neurodevelopmental Outcomes to 2 Years After Extremely Preterm Birth. *JAMA Pediatr*. Published online July 19, 2021. doi:10.1001/jamapediatrics.2021.2052
9. Zeitlin J, Sentenac M, Morgan AS, et al. Priorities for collaborative research using very preterm birth cohorts. *Arch Dis Child Fetal Neonatal Ed*. 2020;105(5):538-544. doi:10.1136/archdischild-2019-317991
10. de Kieviet JF, Piek JP, Aarnoudse-Moens CS, Oosterlaan J. Motor development in very preterm and very low-birth-weight children from birth to adolescence: a meta-analysis. *JAMA*. 2009;302(20):2235-2242. doi:10.1001/jama.2009.1708
11. Baron IS, Rey-Casserly C. Extremely preterm birth outcome: a review of four decades of cognitive research. *Neuropsychol Rev*. 2010;20(4):430-452. doi:10.1007/s11065-010-9132-z
12. Linsell L, Malouf R, Morris J, Kurinczuk JJ, Marlow N. Prognostic factors for cerebral palsy and motor impairment in children born very preterm or very low birthweight: a systematic review. *Dev Med Child Neurol*. 2016;58(6):554-569. doi:10.1111/dmcn.12972
13. Bolk J, Farooqi A, Hafström M, Åden U, Serenius F. Developmental Coordination Disorder and Its Association With Developmental Comorbidities at 6.5 Years in

- Apparently Healthy Children Born Extremely Preterm. *JAMA Pediatr.* 2018;172(8):765-774. doi:10.1001/jamapediatrics.2018.1394
14. Van Hus JW, Potharst ES, Jeukens-Visser M, Kok JH, Van Wassenaer-Leemhuis AG. Motor impairment in very preterm-born children: links with other developmental deficits at 5 years of age. *Dev Med Child Neurol.* 2014;56(6):587-594. doi:10.1111/dmcn.12295
 15. Husby IM, Stray KMT, Olsen A, et al. Long-term follow-up of mental health, health-related quality of life and associations with motor skills in young adults born preterm with very low birth weight. *Health Qual Life Outcomes.* 2016;14:56. doi:10.1186/s12955-016-0458-y
 16. Oudgenoeg-Paz O, Mulder H, Jongmans MJ, van der Ham IJM, Van der Stigchel S. The link between motor and cognitive development in children born preterm and/or with low birth weight: A review of current evidence. *Neurosci Biobehav Rev.* 2017;80:382-393. doi:10.1016/j.neubiorev.2017.06.009
 17. Blank R, Barnett AL, Cairney J, et al. International clinical practice recommendations on the definition, diagnosis, assessment, intervention, and psychosocial aspects of developmental coordination disorder. *Dev Med Child Neurol.* 2019;61(3):242-285. doi:10.1111/dmcn.14132
 18. Spittle AJ, Dewey D, Nguyen TNN, et al. Rates of Developmental Coordination Disorder in Children Born Very Preterm. *J Pediatr.* 2021;231:61-67.e2. doi:10.1016/j.jpeds.2020.12.022
 19. Golding J, Emmett P, Iles-Caven Y, Steer C, Lingam R. A review of environmental contributions to childhood motor skills. *J Child Neurol.* 2014;29(11):1531-1547. doi:10.1177/0883073813507483
 20. Williams J, Lee KJ, Anderson PJ. Prevalence of motor-skill impairment in preterm children who do not develop cerebral palsy: a systematic review. *Dev Med Child Neurol.* 2010;52(3):232-237. doi:https://doi.org/10.1111/j.1469-8749.2009.03544.x
 21. Setänen S, Lehtonen L, Parkkola R, Matomäki J, Haataja L. The motor profile of preterm infants at 11 y of age. *Pediatr Res.* 2016;80(3):389-394. doi:10.1038/pr.2016.90
 22. Bos AF, Van Braeckel KNJA, Hitzert MM, Tanis JC, Roze E. Development of fine motor skills in preterm infants. *Dev Med Child Neurol.* 2013;55 Suppl 4:1-4. doi:10.1111/dmcn.12297
 23. Linsell L, Malouf R, Morris J, Kurinczuk JJ, Marlow N. Risk Factor Models for Neurodevelopmental Outcomes in Children Born Very Preterm or With Very Low Birth Weight: A Systematic Review of Methodology and Reporting. *Am J Epidemiol.* 2017;185(7):601-612. doi:10.1093/aje/kww135
 24. Henderson SE, Sugden DA, Barnett AL. *Movement Assessment Battery for Children-2 (2nd Ed.)*. Psychological corporation.; 2007.

25. Zeitlin J, Maier RF, Cuttini M, et al. Cohort Profile: Effective Perinatal Intensive Care in Europe (EPICE) very preterm birth cohort. *Int J Epidemiol.* 2020;49(2):372-386. doi:10.1093/ije/dyz270
26. Janssen AJWM, der Sanden MWGN van, Akkermans RP, Tissingh J, Oostendorp RAB, Kollée LAA. A model to predict motor performance in preterm infants at 5 years. *Early Hum Dev.* 2009;85(9):599-604. doi:10.1016/j.earlhumdev.2009.07.001
27. Dewey D, Creighton DE, Heath JA, et al. Assessment of Developmental Coordination Disorder in Children Born With Extremely Low Birth Weights. *Dev Neuropsychol.* 2011;36(1):42-56. doi:10.1080/87565641.2011.540535
28. Janssen AJWM, Oostendorp RAB, Akkermans RP, Steiner K, Kollée LAA, Nijhuis-van der Sanden MWG. High variability of individual longitudinal motor performance over five years in very preterm infants. *Res Dev Disabil.* 2016;59:306-317. doi:10.1016/j.ridd.2016.09.017
29. Rosenbaum P, Paneth N, Leviton A, et al. A report: the definition and classification of cerebral palsy April 2006. *Dev Med Child Neurol Suppl.* 2007;109:8-14.
30. Blank R, Smits-Engelsman B, Polatajko H, Wilson P, European Academy for Childhood Disability. European Academy for Childhood Disability (EACD): recommendations on the definition, diagnosis and intervention of developmental coordination disorder (long version). *Dev Med Child Neurol.* 2012;54(1):54-93. doi:10.1111/j.1469-8749.2011.04171.x
31. Smits-Engelsman B. *Movement Assessment Battery for Children-2, Dutch Adaptation, 2nd Ed.* Pearson Assessment.; 2010.
32. Marquet-Doléac J, Soppelsa R, Albaret JM. *Movement Assessment Battery for Children-2, French Adaptation, 2nd Ed.* Pearson France-ECPA.; 2016.
33. Biancotto M, Borean M, Bravar L, Pelamatti GM, Zoia S. *Movement Assessment Battery for Children-2, Italian Adaptation, 2nd Ed.* Giunti O.S.; 2013.
34. Costa R, Johnson S, Cuttini M, et al. The impact of choice of norms on classification of motor impairment for children born very preterm. *Early Hum Dev.* Published online May 7, 2020:105056. doi:10.1016/j.earlhumdev.2020.105056
35. Henderson SE, Sugden DA. *Movement Assessment Battery for Children.* Published online 1992.
36. UNESCO Institute for Statistics. *International Standard Classification of Education: ISCED 2011.* UNESCO Institute for Statistics; 2012. <http://uis.unesco.org/sites/default/files/documents/international-standard-classification-of-education-isced-2011-en.pdf>
37. Zeitlin J, Bonamy AKE, Piedvache A, et al. Variation in term birthweight across European countries affects the prevalence of small for gestational age among very preterm infants. *Acta Paediatr Oslo Nor 1992.* 2017;106(9):1447-1455. doi:10.1111/apa.13899

38. Draper ES, Manktelow BN, Cuttini M, et al. Variability in Very Preterm Stillbirth and In-Hospital Mortality Across Europe. *Pediatrics*. 2017;139(4). doi:10.1542/peds.2016-1990
39. Nuytten A, Behal H, Duhamel A, et al. Evidence-Based Neonatal Unit Practices and Determinants of Postnatal Corticosteroid-Use in Preterm Births below 30 Weeks GA in Europe. A Population-Based Cohort Study. *PLoS One*. 2017;12(1):e0170234. doi:10.1371/journal.pone.0170234
40. Hernán MA, Robins JM. Estimating causal effects from epidemiological data. *J Epidemiol Community Health*. 2006;60(7):578-586. doi:10.1136/jech.2004.029496
41. Seaman SR, White IR. Review of inverse probability weighting for dealing with missing data. *Stat Methods Med Res*. 2013;22(3):278-295. doi:10.1177/0962280210395740
42. Bonnet C, Blondel B, Piedvache A, et al. Low breastfeeding continuation to 6 months for very preterm infants: A European multiregional cohort study. *Matern Child Nutr*. 2019;15(1):e12657. doi:10.1111/mcn.12657
43. Seppänen AV, Sauvegrain P, Draper ES, et al. Parents' ratings of post-discharge healthcare for their children born very preterm and their suggestions for improvement: a European cohort study. *Pediatr Res*. 2021;89(4):1004-1012. doi:10.1038/s41390-020-01120-y
44. Piedvache A, van Buuren S, Barros H, et al. Strategies for assessing the impact of loss to follow-up on estimates of neurodevelopmental impairment in a very preterm cohort at 2 years of age. *BMC Med Res Methodol*. 2021;21(1):118. doi:10.1186/s12874-021-01264-3
45. Royston P, White IR. Multiple Imputation by Chained Equations (MICE): Implementation in Stata. *J Stat Softw*. 2011;45(1):1-20. doi:10.18637/jss.v045.i04
46. White IR, Royston P, Wood AM. Multiple imputation using chained equations: Issues and guidance for practice. *Stat Med*. 2011;30(4):377-399. doi:https://doi.org/10.1002/sim.4067
47. Seaman SR, White IR, Copas AJ, Li L. Combining Multiple Imputation and Inverse-Probability Weighting. *Biometrics*. 2012;68(1):129-137. doi:https://doi.org/10.1111/j.1541-0420.2011.01666.x
48. Edwards J, Berube M, Erlandson K, et al. Developmental Coordination Disorder in School-Aged Children Born Very Preterm and/or at Very Low Birth Weight: A Systematic Review. *J Dev Behav Pediatr*. 2011;32(9):678-687. doi:10.1097/DBP.0b013e31822a396a
49. Caravale B, Herich L, Zoia S, et al. Risk of Developmental Coordination Disorder in Italian very preterm children at school age compared to general population controls. *Eur J Paediatr Neurol EJPN Off J Eur Paediatr Neurol Soc*. 2019;23(2):296-303. doi:10.1016/j.ejpn.2019.01.002
50. Evensen KAI, Ustad T, Tikanmäki M, Haaramo P, Kajantie E. Long-term motor outcomes of very preterm and/or very low birth weight individuals without cerebral

- palsy: A review of the current evidence. *Semin Fetal Neonatal Med.* 2020;25(3):101116. doi:10.1016/j.siny.2020.101116
51. Lean RE, Paul RA, Smyser TA, Smyser CD, Rogers CE. Social Adversity and Cognitive, Language and Motor Development of Very Preterm Children from 2 to 5 Years of Age. *J Pediatr.* 2018;203:177-184.e1. doi:10.1016/j.jpeds.2018.07.110
 52. Taylor HG, Klein N, Drotar D, Schluchter M, Hack M. Consequences and risks of <1000-g birth weight for neuropsychological skills, achievement, and adaptive functioning. *J Dev Behav Pediatr JDBP.* 2006;27(6):459-469. doi:10.1097/00004703-200612000-00002
 53. Goyen TA, Lui K. Developmental coordination disorder in “apparently normal” schoolchildren born extremely preterm. *Arch Dis Child.* 2009;94(4):298-302. doi:10.1136/adc.2007.134692
 54. Smits-Engelsman BCM, Blank R, van der Kaay AC, et al. Efficacy of interventions to improve motor performance in children with developmental coordination disorder: a combined systematic review and meta-analysis. *Dev Med Child Neurol.* 2013;55(3):229-237. doi:10.1111/dmcn.12008
 55. Spittle A, Orton J, Anderson PJ, Boyd R, Doyle LW. Early developmental intervention programmes provided post hospital discharge to prevent motor and cognitive impairment in preterm infants. *Cochrane Database Syst Rev.* 2015;(11):CD005495. doi:10.1002/14651858.CD005495.pub4
 56. Vohr BR, Wright LL, Poole WK, McDonald SA. Neurodevelopmental outcomes of extremely low birth weight infants <32 weeks’ gestation between 1993 and 1998. *Pediatrics.* 2005;116(3):635-643. doi:10.1542/peds.2004-2247
 57. Janssen AJWM, Sanden MWGN van der, Akkermans RP, Oostendorp R a. B, Kollée L a. A. Influence of behaviour and risk factors on motor performance in preterm infants at age 2 to 3 years. *Dev Med Child Neurol.* 2008;50(12):926-931. doi:10.1111/j.1469-8749.2008.03108.x
 58. Messinger D, Lambert B, Bauer CR, Bann CM, Hamlin-Smith K, Das A. The Relationship between Behavior Ratings and Concurrent and Subsequent Mental and Motor Performance in Toddlers Born at Extremely Low Birth Weight. *J Early Interv.* 2010;32(3):214-233. doi:10.1177/1053815110380917
 59. Charkaluk ML, Truffert P, Fily A, Ancel PY, Pierrat V, Epipage study group. Neurodevelopment of children born very preterm and free of severe disabilities: the Nord-Pas de Calais Epipage cohort study. *Acta Paediatr Oslo Nor 1992.* 2010;99(5):684-689. doi:10.1111/j.1651-2227.2010.01695.x
 60. European Union. EU Physical Activity Guidelines: Recommended Policy Actions in Support of Health-Enhancing Physical Activity. Published online 2008. Accessed June 4, 2021. https://ec.europa.eu/assets/eac/sport/library/policy_documents/eu-physical-activity-guidelines-2008_en.pdf

61. Daugbjerg SB, Kahlmeier S, Racioppi F, et al. Promotion of physical activity in the European region: content analysis of 27 national policy documents. *J Phys Act Health*. 2009;6(6):805-817. doi:10.1123/jpah.6.6.805
62. WHO. Physical activity strategy for the WHO European Region 2016-2025. Published online 2015. Accessed June 4, 2021. https://www.euro.who.int/__data/assets/pdf_file/0010/282961/65wd09e_PhysicalActivityStrategy_150474.pdf
63. Hills AP, Dengel DR, Lubans DR. Supporting public health priorities: recommendations for physical education and physical activity promotion in schools. *Prog Cardiovasc Dis*. 2015;57(4):368-374. doi:10.1016/j.pcad.2014.09.010
64. Cheung PC, Franks PA, Kramer MR, et al. Elementary school physical activity opportunities and physical fitness of students: A statewide cross-sectional study of schools. *PloS One*. 2019;14(1):e0210444. doi:10.1371/journal.pone.0210444
65. Yuksel HS, Şahin FN, Maksimovic N, Drid P, Bianco A. School-Based Intervention Programs for Preventing Obesity and Promoting Physical Activity and Fitness: A Systematic Review. *Int J Environ Res Public Health*. 2020;17(1). doi:10.3390/ijerph17010347
66. Hernán MA, Hsu J, Healy B. A Second Chance to Get Causal Inference Right: A Classification of Data Science Tasks. *CHANCE*. 2019;32(1):42-49. doi:10.1080/09332480.2019.1579578

Table 1. Characteristics of children included in the study and comparison with children who had missing Movement ABC-2 scores (with IPW).^a

	Children included in the study		Children eligible for inclusion but without Movement ABC-2		<i>p</i> -value ^b
	N	%	N	%	
	772		119		
Sociodemographic characteristics					
Maternal age at childbirth (years)					0.001
<25	123	16.0	16	13.0	
25-34	446	57.9	87	73.5	
≥35	201	26.1	16	13.5	
Missing	2	0.3	0	0.1	
Parental cohabiting status					0.89
Married/Couple/Cohabiting	617	84.9	101	87.0	
Single/Other	110	15.1	15	13.0	
Missing	45	5.8	3	2.5	
Maternal educational level					0.88
≤Lower secondary	141	19.0	22	19.5	
Upper secondary/Short tertiary	326	44.0	56	48.9	
≥Bachelor	274	37.0	36	31.6	
Missing	31	4.0	5	4.2	
Household unemployment status					
Employed or other situation ^c	623	86.5	93	81.9	
At least one parent unemployed	97	13.5	21	18.1	
Missing	52	6.7	5	4.2	
Parity					0.75
First child	446	58.5	73	62.1	
Second child	180	23.6	27	22.8	
Third child or more	137	17.9	18	15.1	
Missing	9	1.2	1	0.8	
Maternal country of birth					0.94
Native-born	570	74.1	87	72.9	
Other European country	57	7.4	7	6.0	
Non-European country	143	18.6	25	21.1	
Missing	3	0.4	0	0.0	
Perinatal and neonatal characteristics					
GA (weeks)					0.03
≤24	93	12.0	19	16.1	
25	128	16.6	29	24.3	
26	231	29.9	30	24.8	
27	320	41.4	41	34.8	
Missing	0	0.0	0	0.1	
SGA					0.24
<3 rd percentile	114	14.8	15	12.9	
3-9 th percentile	64	8.3	6	5.0	
≥10 th percentile	594	77.0	98	82.1	
Missing	0	0.0	0	0.0	
Child sex					0.19
Female	387	50.2	52	43.6	
Male	385	49.8	67	56.4	
Missing	0	0.0	0	0.0	
Multiple birth					0.69
Singleton	555	71.9	84	70.8	
Multiple	217	28.1	35	29.2	

Missing	0	0.0	0	0.0	
Congenital anomaly					0.96
No	719	93.2	109	91.6	
Yes	53	6.8	10	8.4	
Missing	0	0.0	0	0.0	
Severe neonatal morbidity^d					0.16
No	604	79.7	88	75.2	
Yes	153	20.3	29	24.8	
Missing	15	1.9	2	1.7	
BPD					0.30
No	500	66.5	82	70.0	
Yes	252	33.5	35	30.0	
Missing	20	2.6	2	1.7	
Breastfeeding at discharge					
No	343	45.1	70	60.8	
Yes	417	54.9	45	39.2	
Missing	12	1.6	4	3.4	
Characteristics of participants					
Age at assessment in years, mean (SD)	5.7	(0.4)	5.6	(0.4)	0.90
Neurodevelopmental impairment^e					0.92
None	434	56.3	71	59.9	
Mild	255	33.1	36	30.0	
Moderate	82	10.7	12	10.0	
Missing	0	0.0	0	0.0	
Child development at 2 years of age^f					
Global motor impairment^g					0.49
No	619	96.3	92	95.5	
Yes	24	3.7	4	4.5	
Missing	129	16.7	23	19.3	
Learning disability^h					<0.001
No	537	85.4	65	69.4	
Yes	92	14.6	29	30.6	
Missing	143	18.5	26	21.8	
Country (region)					
Belgium (Flanders)	50	6.5	9	7.7	
Denmark (Eastern Region)	46	6.0	10	8.1	
Estonia (entire country)	21	2.7	2	1.6	
France (Burgundy, Ile-de-France, Northern Region)	122	15.7	16	13.5	
Germany (Hesse, Saarland)	75	9.7	20	16.4	
Italy (Emilia-Romagna, Lazio, Marche)	98	12.6	24	19.8	
The Netherlands (Central Eastern)	50	6.5	2	1.9	
Poland (Wielkopolska)	24	3.1	9	7.8	
Portugal (Lisbon, Northern Region)	76	9.9	13	10.9	
The United Kingdom (East Midlands, Northern, Yorkshire and the Humber)	186	24.1	5	3.8	
Sweden (Greater Stockholm)	24	3.1	10	8.4	

Abbreviations: Movement ABC-2, Movement Assessment Battery for Children – 2nd Edition. GA, gestational age. SGA, small for gestational age. BPD, bronchopulmonary dysplasia.

^aValues are N rounded to a whole number, % (excluding missing values) rounded to one decimal, and mean (SD) for continuous variables, all with the use of inverse probability weighting (IPW) to correct loss to follow-up.

^bP-values from Wald test of logistic regressions adjusted on country.

^cOther situations included student, parental leave, home parent and other.

^dIncluded IVH grade III/IV, cPVL, retinopathy of prematurity stage III or more, and necrotizing enterocolitis.

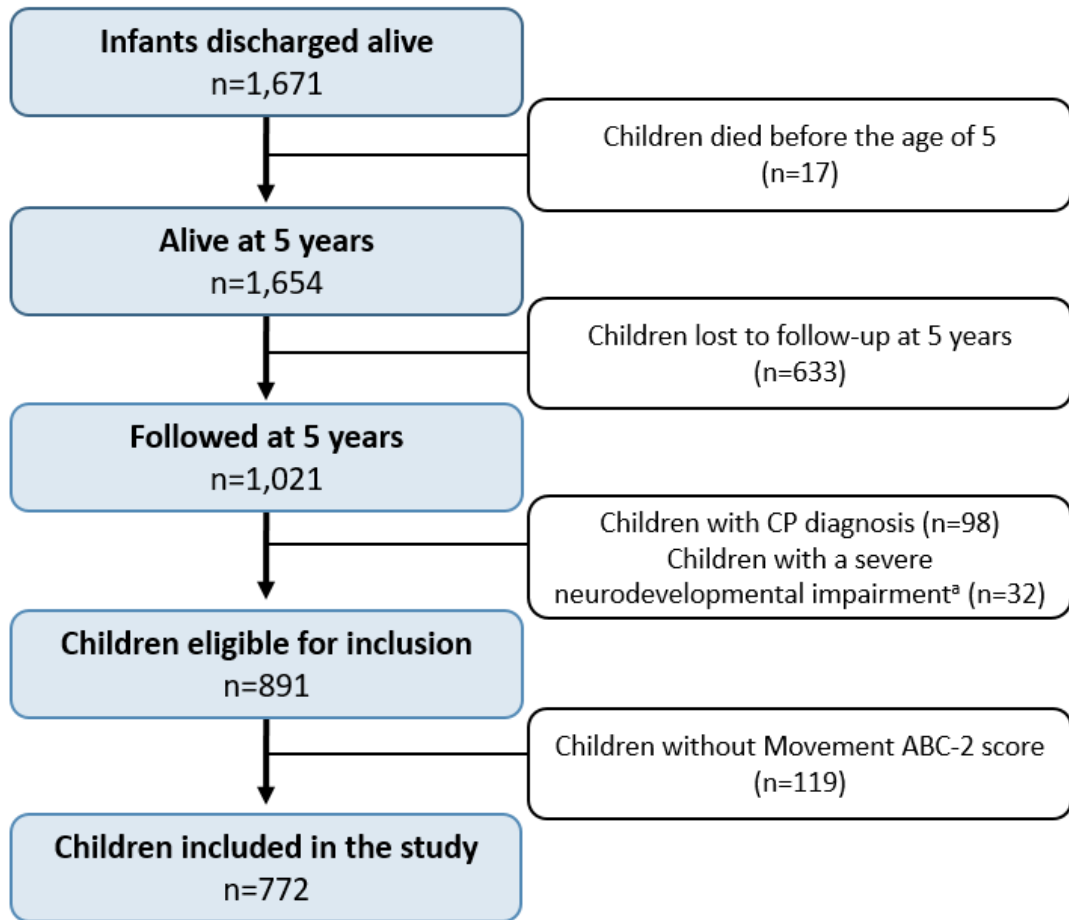
^eCombined cognitive, hearing and visual impairment.

^fData from the parental questionnaire filled at 2 years corrected age: 647 over 772 (83.8%) and 96 over 119 (80.7%) children have been followed at this stage.

^gGlobal motor impairment at 2 years of age estimated from 3 parental-reported questions on abilities on walking, sitting, and head holding.

^hLearning disability at 2 years of age estimated from the Parent Report of Children's Abilities-Revised (or the Ages and Stages Questionnaires for France only).

Figure 1. Flowchart of the sample selection from the SHIPS' cohort (children born <28 gestational weeks).



Abbreviations: CP, cerebral palsy. Movement ABC-2, Movement Assessment Battery for Children – 2nd Edition.

^aDefined as an intelligence quotient (IQ) ≤ 54 ($< -3SD$) or severe hearing or visual impairment.

Table 2. Rates of movement difficulties, in total and by component (based on Movement ABC-2).^a

	Movement difficulties					
	None (>15 th percentile)		At risk (6 th -15 th percentile) ^b		Significant (≤5 th percentile)	
	N	%	N	%	N	%
Total ^c	349	45.2	179	23.2	244	31.7
Manual dexterity ^d	313	41.2	162	21.3	284	37.4
Aiming and catching ^d	542	71.5	71	9.4	145	19.2
Balance ^d	478	63.0	131	17.3	149	19.7

Abbreviations: Movement ABC-2, Movement Assessment Battery for Children – 2nd Edition.

^aValues are N rounded to a whole number and % (excluding missing values) rounded to one decimal; both with the use of inverse probability weighting (IPW) to correct loss to follow-up.

^bAs explained in the Movement ABC-2 manual,²⁴ the 16th percentile is used instead of the 15th percentile to delineate the "at risk of movement difficulties" category.

^cTotal: Movement ABC-2 total score composed of the 3 components (manual dexterity, aiming and catching, and balance).

^dFor the 3 component scores, the total of the n is not necessarily equal to 772 because mainly total scores were imputed when a test-item/a component was missing.

Table 3. Sociodemographic, perinatal and neonatal characteristics over movement difficulties classification (based on Movement ABC-2).^a

	N	Movement difficulties				
		None %	At risk % unadjusted RRR [95% CI]	Significant % unadjusted RRR [95% CI]		
	772	45.2	23.2		31.7	
Sociodemographic characteristics						
Maternal age at childbirth (years)						
<25	123	29.2	24.8	1.80 [0.91-3.57]	45.9	2.71 [1.39-5.29]
25-34	446	46.2	24.6	REF	29.2	REF
≥35	201	53.4	17.6	0.65 [0.41-1.01]	29.0	0.91 [0.59-1.40]
Parental cohabiting status						
Married/Couple/Cohabiting	617	46.6	22.2	REF	31.2	REF
Single/Other	110	45.7	28.0	1.38 [0.75-2.53]	26.3	1.03 [0.54-1.96]
Maternal educational level						
≤Lower secondary	141	38.9	22.0	1.40 [0.76-2.56]	39.1	2.69 [1.47-4.90]
Upper secondary/Short tertiary	326	45.4	22.2	0.99 [0.63-1.57]	32.4	1.21 [0.76-1.93]
≥Bachelor	274	49.2	24.5	REF	26.3	REF
Household unemployment status						
Employed or other situation ^b	623	49.3	21.7	REF	29.0	REF
At least one parent unemployed	97	29.9	31.4	2.61 [1.35-5.07]	38.7	2.20 [1.04-4.68]
Parity						
Primiparous	446	41.9	25.2	1.47 [0.97-2.24]	32.9	1.48 [0.97-2.25]
Multiparous	317	49.4	20.1	REF	30.5	REF
Maternal country of birth						
Native-born	570	44.3	25.1	REF	30.5	REF
Other European country	57	40.2	24.7	1.16 [0.53-2.52]	35.1	1.34 [0.64-2.83]
Non-European country	143	50.2	14.2	0.58 [0.31-1.11]	35.6	1.51 [0.83-2.77]
Perinatal characteristics						
GA (weeks)						
≤24	93	26.8	22.1	1.88 [0.95-3.70]	51.1	4.09 [2.16-7.75]
25	128	38.5	19.4	1.18 [0.66-2.10]	42.1	2.65 [1.52-4.61]
26	231	47.7	24.7	1.17 [0.73-1.86]	27.6	1.31 [0.79-2.18]
27	320	51.3	23.9	REF	24.8	REF
SGA						
<3 rd percentile	114	34.3	28.8	2.04 [1.21-3.45]	36.9	2.00 [1.19-3.38]
3-9 th percentile	64	45.5	18.7	0.86 [0.43-1.74]	35.8	1.17 [0.61-2.28]
≥10 th percentile	594	47.2	22.6	REF	30.2	REF
Child sex						
Female	387	53.5	21.3	REF	25.2	REF
Male	385	36.8	25.0	1.77 [1.19-2.63]	38.2	2.46 [1.61-3.74]
Multiple birth						
Singleton	555	41.6	24.1	REF	34.3	REF
Multiple	217	54.3	20.8	0.63 [0.41-0.97]	24.9	0.59 [0.37-0.95]
Premature rupture of membranes						
No	562	45.0	22.5	REF	32.5	REF
Yes	201	45.3	24.8	1.19 [0.76-1.85]	30.0	1.00 [0.63-1.61]
Antenatal corticosteroids						
No	81	54.7	13.5	0.42 [0.19-0.90]	31.9	0.83 [0.39-1.77]
Yes	686	44.2	24.1	REF	31.7	REF
Congenital anomaly						
No	719	45.6	23.8	REF	30.7	REF
Yes	53	39.3	15.2	0.92 [0.39-2.19]	45.5	2.37 [1.02-5.53]

Neonatal characteristics						
Severe brain lesions (IVH/cPVL)^c						
No	697	46.9	23.5	REF	29.5	REF
Yes	70	28.7	19.1	1.34 [0.66-2.72]	52.2	3.11 [1.69-5.73]
Retinopathy of prematurity						
No	678	48.1	23.1	REF	28.8	REF
Yes	83	22.0	23.1	2.18 [1.08-4.39]	54.9	3.59 [1.88-6.86]
Necrotizing enterocolitis						
No	740	45.8	22.8	REF	31.4	REF
Yes	32	30.5	32.0	1.75 [0.57-5.33]	37.5	1.37 [0.41-4.63]
BPD						
No	500	53.9	22.0	REF	24.1	REF
Yes	252	27.4	25.7	2.25 [1.41-3.59]	46.9	3.65 [2.32-5.73]
Postnatal corticosteroids						
No	541	50.2	23.6	REF	26.1	REF
Yes	220	33.2	21.2	1.56 [0.98-2.46]	45.7	3.55 [2.23-5.65]
Breastfeeding at discharge						
No	343	39.4	23.5	1.38 [0.91-2.11]	37.1	1.69 [1.11-2.59]
Yes	417	50.0	23.1	REF	26.9	REF
Country (region)						
Belgium (Flanders)	50	36.5	39.0	REF	24.5	REF
Denmark (Eastern Region)	46	52.4	28.1	0.49 [0.19-1.31]	19.6	0.39 [0.14-1.12]
Estonia (entire country)	21	57.6	12.1	0.19 [0.05-0.69]	30.3	0.56 [0.21-1.46]
France (Burgundy, Ile-de-France, Northern Region)	122	69.9	17.2	0.23 [0.10-0.50]	12.8	0.32 [0.15-0.67]
Germany (Hesse, Saarland)	75	51.1	16.6	0.29 [0.11-0.78]	32.3	0.89 [0.38-2.08]
Italy (Emilia-Romagna, Lazio, Marche)	98	40.0	23.8	0.57 [0.26-1.25]	36.2	1.10 [0.53-2.28]
The Netherlands (Central Eastern)	50	53.9	33.8	0.58 [0.25-1.33]	12.4	0.28 [0.11-0.68]
Poland (Wielkopolska)	24	15.6	12.1	0.60 [0.14-2.65]	72.3	4.22 [1.36-13.15]
Portugal (Lisbon, Northern Region)	76	41.2	29.3	0.64 [0.28-1.45]	29.6	0.83 [0.37-1.85]
The United Kingdom (East Midlands, Northern, Yorkshire and the Humber)	186	30.2	22.7	0.70 [0.30-1.60]	47.1	1.92 [0.89-4.14]
Sweden (Greater Stockholm)	24	56.8	11.3	0.18 [0.04-0.75]	31.9	0.56 [0.20-1.58]

Abbreviations: Movement ABC-2, Movement Assessment Battery for Children – 2nd Edition. GA, gestational age. SGA, small for gestational age. IVH, intraventricular haemorrhage. cPVL, cystic periventricular leukomalacia. BPD, bronchopulmonary dysplasia.

^aValues are N rounded to a whole number, % [excluding missing values] rounded to one decimal, and relative risk ratios and their 95% confidence intervals (RRR [95% CI]) using multinomial logistic regression taking into consideration clustering within multiple pairs, with country modelled as a fixed effect; all with the use of inverse probability weighting (IPW) to correct loss to follow-up.

^bOther situations included student, parental leave, home parent and other.

^cSevere brain lesions, defined as having an IVH grade III/IV, and/or a cPVL.

Table 4. Association between movement difficulties and sociodemographic and perinatal (Model I), and neonatal (Model II) characteristics among five-year-old children born extremely preterm (N=772).^a

	At risk of movement difficulties		Significant movement difficulties	
	Model I RRR [95% CI]	Model II RRR [95% CI]	Model I RRR [95% CI]	Model II RRR [95% CI]
Sociodemographic characteristics				
Maternal age at childbirth (years)				
<25	1.52 [0.72-3.24]	1.74 [0.79-3.84]	2.22 [1.09-4.50]	2.47 [1.15-5.30]
25-34	REF	REF	REF	REF
≥35	0.70 [0.42-1.17]	0.71 [0.43-1.17]	1.11 [0.68-1.81]	1.10 [0.67-1.80]
Parental cohabiting status				
Married/Couple/Cohabiting	REF	REF	REF	REF
Single/Other	1.41 [0.74-2.69]	1.42 [0.74-2.75]	0.89 [0.41-1.95]	0.91 [0.42-1.95]
Maternal educational level				
≤Lower secondary	1.22 [0.59-2.51]	1.21 [0.58-2.54]	2.14 [0.99-4.65]	2.26 [1.01-5.04]
Upper secondary/Short tertiary	0.89 [0.54-1.47]	0.87 [0.53-1.45]	1.04 [0.60-1.78]	1.02 [0.59-1.80]
≥Bachelor	REF	REF	REF	REF
Household unemployment status				
Employed or other situation ^b	REF	REF	REF	REF
At least one parent unemployed	3.14 [1.56-6.33]	3.16 [1.58-6.31]	2.00 [0.88-4.55]	1.96 [0.87-4.43]
Parity				
Primiparous	1.43 [0.90-2.27]	1.50 [0.94-2.42]	1.77 [1.10-2.85]	1.76 [1.07-2.91]
Multiparous	REF	REF	REF	REF
Maternal country of birth				
Native-born	REF	REF	REF	REF
Other European country	0.97 [0.43-2.18]	1.04 [0.44-2.43]	1.34 [0.59-3.05]	1.50 [0.62-3.61]
Non-European country	0.53 [0.27-1.04]	0.54 [0.27-1.08]	1.74 [0.95-3.18]	1.90 [1.04-3.46]
Perinatal characteristics				
GA (weeks)				
≤24	1.84 [0.85-3.99]	1.45 [0.62-3.44]	4.86 [2.38-9.92]	2.30 [1.03-5.13]
25	1.26 [0.69-2.28]	1.10 [0.59-2.07]	3.51 [1.94-6.32]	2.42 [1.31-4.48]
26	1.25 [0.76-2.05]	1.17 [0.71-1.93]	1.60 [0.92-2.79]	1.34 [0.76-2.36]
27	REF	REF	REF	REF
SGA				
<3 rd percentile	2.19 [1.25-3.84]	1.82 [1.00-3.30]	2.34 [1.27-4.29]	1.59 [0.83-3.04]
3-9 th percentile	1.09 [0.51-2.30]	1.02 [0.47-2.18]	1.78 [0.83-3.79]	1.58 [0.73-3.40]
≥10 th percentile	REF	REF	REF	REF
Child sex				
Female	REF	REF	REF	REF
Male	1.88 [1.24-2.86]	1.81 [1.18-2.76]	2.62 [1.68-4.08]	2.23 [1.42-3.51]
Multiple birth				
Singleton	REF	REF	REF	REF
Multiple	0.67 [0.44-1.03]	0.65 [0.42-1.01]	0.79 [0.48-1.31]	0.78 [0.46-1.33]
Premature rupture of membranes				
No	REF	REF	REF	REF
Yes	1.12 [0.69-1.84]	1.14 [0.69-1.88]	1.02 [0.61-1.69]	1.04 [0.62-1.72]
Antenatal corticosteroids				
No	0.36 [0.16-0.84]	0.35 [0.15-0.81]	0.86 [0.37-2.02]	0.80 [0.33-1.96]
Yes	REF	REF	REF	REF
Congenital anomaly				
No	REF	REF	REF	REF
Yes	0.69 [0.27-1.75]	0.69 [0.27-1.76]	2.28 [0.92-5.64]	2.33 [0.95-5.72]

Neonatal characteristics					
Severe brain lesions (IVH/cPVL)^c					
No		REF		REF	
Yes		1.31 [0.63-2.73]		2.17 [1.14-4.12]	
Retinopathy of prematurity					
No		REF		REF	
Yes		1.21 [0.53-2.75]		1.34 [0.66-2.76]	
Necrotizing enterocolitis					
No		REF		REF	
Yes		1.54 [0.57-4.19]		1.10 [0.41-2.96]	
BPD					
No		REF		REF	
Yes		1.94 [1.13-3.33]		2.54 [1.47-4.40]	
Postnatal corticosteroids					
No		REF		REF	
Yes		1.05 [0.61-1.82]		1.94 [1.09-3.44]	
Breastfeeding at discharge					
No		1.01 [0.62-1.64]		0.98 [0.59-1.62]	
Yes		REF		REF	
Country (region)					
Belgium (Flanders)		REF	REF	REF	REF
Denmark (Eastern Region)	0.40 [0.14-1.13]		0.42 [0.15-1.19]	0.63 [0.18-2.18]	0.66 [0.20-2.21]
Estonia (entire country)	0.15 [0.04-0.55]		0.16 [0.04-0.59]	0.85 [0.28-2.60]	0.85 [0.26-2.82]
France (Burgundy, Ile-de-France, Northern Region)	0.18 [0.08-0.43]		0.19 [0.08-0.47]	0.21 [0.07-0.56]	0.20 [0.07-0.54]
Germany (Hesse, Saarland)	0.21 [0.07-0.61]		0.24 [0.08-0.72]	0.57 [0.19-1.72]	0.64 [0.21-1.97]
Italy (Emilia-Romagna, Lazio, Marche)	0.53 [0.23-1.25]		0.56 [0.23-1.35]	1.85 [0.72-4.78]	1.80 [0.70-4.64]
The Netherlands (Central Eastern)	0.55 [0.22-1.33]		0.52 [0.21-1.29]	0.31 [0.10-0.98]	0.26 [0.08-0.88]
Poland (Wielkopolska)	0.70 [0.13-3.65]		0.81 [0.15-4.35]	8.75 [1.98-38.59]	9.61 [2.09-44.17]
Portugal (Lisbon, Northern Region)	0.52 [0.22-1.26]		0.55 [0.22-1.37]	1.10 [0.41-2.98]	1.15 [0.42-3.17]
The United Kingdom (East Midlands, Northern, Yorkshire and the Humber)	0.63 [0.27-1.48]		0.53 [0.22-1.32]	3.03 [1.16-7.91]	2.46 [0.87-6.92]
Sweden (Greater Stockholm)	0.15 [0.03-0.68]		0.14 [0.03-0.67]	0.56 [0.15-2.06]	0.61 [0.15-2.44]

Abbreviations: Movement ABC-2, Movement Assessment Battery for Children – 2nd Edition. GA, gestational age. SGA, small for gestational age. IVH, intraventricular haemorrhage. cPVL, cystic periventricular leukomalacia. BPD, bronchopulmonary dysplasia.

^aValues are relative risk ratios and their 95% confidence intervals (RRR [95% CI]) from multinomial logistic regression models: adjusted on sociodemographic and perinatal factors (Model I), and adjusted additionally on neonatal factors (Model II); both taking into consideration clustering within multiple pairs, with country modelled as a fixed effect, and with the use of inverse probability weighting (IPW) and multiple imputed dataset.

^bOther situations included student, parental leave, home parent and other.

^cSevere brain lesions, defined as having an IVH grade III/IV, and/or a cPVL.

Supplemental Table 1. Characteristics of children followed and lost to follow-up at 5 years of age (without IPW).^a

	Children followed at 5 years of age		Children lost to follow-up at 5 years		<i>p</i> -value ^b
	N	%	N	%	
	1,021		633		
Sociodemographic characteristics					
Maternal age at childbirth (years)					<0.001
<25	121	11.9	151	24.0	
25-34	610	60.0	353	56.2	
≥35	286	28.1	124	19.7	
Missing	4	0.4	5	0.8	
Parity					0.004
First child	604	59.9	335	53.7	
Second child	252	25.0	152	24.4	
Third child or more	153	15.2	137	22.0	
Missing	12	1.2	9	1.4	
Maternal country of birth					<0.001
Native-born	786	77.2	384	65.3	
Other European country	67	6.6	51	8.7	
Non-European country	165	16.2	153	26.0	
Missing	3	0.3	45	7.1	
Perinatal and neonatal characteristics					
GA (weeks)					0.652
≤24	132	12.9	108	17.1	
25	191	18.7	111	17.5	
26	292	28.6	183	28.9	
27	406	39.8	231	36.5	
Missing	0	0.0	0	0.0	
SGA					0.021
<3 rd percentile	157	15.4	73	11.5	
3-9 th percentile	82	8.0	45	7.1	
≥10 th percentile	782	76.6	515	81.4	
Missing	0	0.0	0	0.0	
Child sex					0.82
Female	489	47.9	296	46.8	
Male	532	52.1	337	53.2	
Missing	0	0.0	0	0.0	
Multiple birth					0.292
Singleton	733	71.8	469	74.1	
Multiple	288	28.2	164	25.9	
Missing	0	0.0	0	0.0	
Congenital anomaly					0.244
No	936	91.7	583	92.1	
Yes	85	8.3	50	7.9	
Missing	0	0.0	0	0.0	
Severe neonatal morbidity^c					0.307
No	747	74.6	434	71.3	
Yes	255	25.4	175	28.7	
Missing	19	1.9	24	3.8	
BPD					0.646
No	663	66.6	373	60.7	
Yes	333	33.4	241	39.3	
Missing	25	2.4	19	3.0	

Breastfeeding at discharge				
No	447	44.7	341	56.7
Yes	554	55.3	260	43.3
Missing	20	2.0	32	5.1
				<i><0.001</i>
Global				
Followed-up at 2 years of age				
No	175	17.1	361	57.0
Yes	846	82.9	272	43.0
Missing	0	0.0	0	0.0
				<i><0.001</i>
Country (region)				
Belgium (Flanders)	70	55.1	57	44.9
Denmark (Eastern Region)	52	59.8	35	40.2
Estonia (entire country)	38	100.0	0	0.0
France (Burgundy, Ile-de-France, Northern Region)	189	71.6	75	28.4
Germany (Hesse, Saarland)	79	42.7	106	57.3
Italy (Emilia-Romagna, Lazio, Marche)	173	77.6	50	22.4
The Netherlands (Central Eastern)	75	85.2	13	14.8
Poland (Wielkopolska)	52	78.8	14	21.2
Portugal (Lisbon, Northern Region)	113	72.4	43	27.6
The United Kingdom (East Midlands, Northern, Yorkshire and the Humber)	138	38.7	219	61.3
Sweden (Greater Stockholm)	42	66.7	21	33.3

Abbreviations: Movement ABC-2, Movement Assessment Battery for Children – 2nd Edition. GA, gestational age. SGA, small for gestational age. BPD, bronchopulmonary dysplasia.

^aValues are frequencies (N), and % (excluding missing values) rounded to one decimal, all without the use of inverse probability weighting (IPW) to correct loss to follow-up.

^bP-values from Wald test of logistic regressions adjusted on country.

^cIncluded IVH grade III/IV, cPVL, retinopathy of prematurity stage III or more, and necrotizing enterocolitis.

Supplemental Table 2. List of the variables included in the multiple imputation by chained equations and IPW programs.

Perinatal/Neonatal			Sociodemographic
Previous caesarean section	Gestational age	Severe neonatal morbidity ^a	Maternal age at childbirth
Antepartum haemorrhage after week 20	Small for gestational age	Bronchopulmonary dysplasia	Maternal country of birth
Admission for preterm labor/contractions after week 20	Birthweight	Any surgery before discharge	Maternal parity before childbirth
The mother has preeclampsia/eclampsia/HELLP	Apgar score <7	Use of any continuous positive airway pressure	Country
Premature rupture of membranes (>12hours)	Child sex	Use of mechanical ventilation	
Antenatal corticosteroids	Multiple pregnancy	Prophylactic surfactant in the 2 hours after birth	
Delivery in maternity level 3	Hospital transfer during neonatal care	Breastfeeding at discharge	
Mode of delivery	Congenital anomalies		

Abbreviations: IPW, inverse probability weighting, HELLP syndrome, Hemolysis, Elevated Liver enzyme, Low Platelets syndrome.

^aIncluded IVH grade III/IV, cPVL, retinopathy of prematurity stage III or more, and necrotizing enterocolitis.

Supplemental Table 3. Characteristics of children included in the study and comparison with children who had missing Movement ABC-2 scores – Sensitivity without IPW.^a

	Children included in the study		Children eligible for inclusion but without Movement ABC-2		<i>p-value</i> ^b
	N	%	N	%	
	772		119		
Sociodemographic characteristics					
Maternal age at childbirth (years)					<0.001
<25	89	11.6	14	11.8	
25-34	451	58.6	87	73.1	
≥35	230	29.9	18	15.1	
Missing	2	0.3	0	0.0	
Parental cohabiting status					0.97
Married/Couple/Cohabiting	621	85.4	101	87.1	
Single/Other	106	14.6	15	12.9	
Missing	45	5.8	3	2.5	
Maternal educational level					0.57
≤Lower secondary	132	17.8	19	16.7	
Upper secondary/Short tertiary	319	43.0	60	52.6	
≥Bachelor	290	39.1	35	30.7	
Missing	31	4.0	5	4.2	
Household unemployment status					
Employed or other situation ^c	633	87.9	93	81.6	
At least one parent unemployed	87	12.1	21	18.4	
Missing	52	6.7	5	4.2	
Parity					0.59
First child	464	60.8	76	64.4	
Second child	189	24.8	27	22.9	
Third child or more	110	14.4	15	12.7	
Missing	9	1.2	1	0.8	
Maternal country of birth					0.82
Native-born	602	78.3	92	77.3	
Other European country	51	6.6	7	5.9	
Non-European country	116	15.1	20	16.8	
Missing	3	0.4	0	0.0	
Perinatal and neonatal characteristics					
GA (weeks)					0.03
≤24	85	11.0	19	16.0	
25	132	17.1	27	22.7	
26	233	30.2	30	25.2	
27	322	41.7	43	36.1	
Missing	0	0.0	0	0.0	
SGA					0.12
<3 rd percentile	124	16.1	15	12.6	
3-9 th percentile	67	8.7	7	5.9	
≥10 th percentile	581	75.3	97	81.5	
Missing	0	0.0	0	0.0	
Child sex					0.10
Female	393	50.9	51	42.9	
Male	379	49.1	68	57.1	
Missing	0	0.0	0	0.0	
Multiple birth					0.88

Singleton	550	71.2	85	71.4	
Multiple	222	28.8	34	28.6	
Missing	0	0.0	0	0.0	
Congenital anomaly					<i>0.84</i>
No	714	92.5	108	90.8	
Yes	58	7.5	11	9.2	
Missing	0	0.0	0	0.0	
Severe neonatal morbidity^d					<i>0.07</i>
No	607	80.2	86	73.5	
Yes	150	19.8	31	26.5	
Missing	15	1.9	2	1.7	
BPD					<i>0.31</i>
No	519	69.0	82	70.1	
Yes	233	31.0	35	29.9	
Missing	20	2.6	2	1.7	
Breastfeeding at discharge					
No	311	40.9	68	59.1	
Yes	449	59.1	47	40.9	
Missing	12	1.6	4	3.4	
Characteristics of participants					
Age at assessment in years, mean (SD)	5.6	(0.3)	5.6	(0.4)	<i>0.90</i>
Neurodevelopmental impairment^e					<i>0.79</i>
None	454	58.8	71	59.7	
Mild	242	31.3	36	30.3	
Moderate	76	9.8	12	10.1	
Missing	0	0.0	0	0.0	
Child development at 2 years of age^f					
Global motor impairment^g					<i>0.13</i>
No	625	97.2	91	94.8	
Yes	18	2.8	5	5.2	
Missing	129	16.7	23	19.3	
Learning disability^h					<i><0.001</i>
No	544	86.5	63	67.7	
Yes	85	13.5	30	32.3	
Missing	143	18.5	26	21.8	
Country (region)					
Belgium (Flanders)	48	6.2	7	5.9	
Denmark (Eastern Region)	40	5.2	9	7.6	
Estonia (entire country)	33	4.3	3	2.5	
France (Burgundy, Ile-de-France, Northern Region)	143	18.5	16	13.4	
Germany (Hesse, Saarland)	53	6.9	14	11.8	
Italy (Emilia-Romagna, Lazio, Marche)	123	15.9	28	23.5	
The Netherlands (Central Eastern)	69	8.9	3	2.5	
Poland (Wielkopolska)	31	4.0	11	9.2	
Portugal (Lisbon, Northern Region)	90	11.7	15	12.6	
The United Kingdom (East Midlands, Northern, Yorkshire and the Humber)	116	15.0	3	2.5	
Sweden (Greater Stockholm)	26	3.4	10	8.4	

Abbreviations: Movement ABC-2, Movement Assessment Battery for Children – 2nd Edition. GA, gestational age. SGA, small for gestational age. BPD, bronchopulmonary dysplasia.

^aValues are frequencies (N), % (excluding missing values) rounded to one decimal, and mean (SD) for continuous variables, all without the use of inverse probability weighting (IPW) to correct loss to follow-up.

^bP-values from Wald test of logistic regressions adjusted on country.

^cOther situations included student, parental leave, home parent and other.

^dIncluded IVH grade III/IV, cPVL, retinopathy of prematurity stage III or more, and necrotizing enterocolitis.

^eCombined cognitive, hearing and visual impairment.

^fData from the parental questionnaire filled at 2 years corrected age: 647 over 772 (83.8%) and 96 over 119 (80.7%) children have been followed at this stage.

^gGlobal motor impairment at 2 years of age estimated from 3 parental-reported questions on abilities on walking, sitting, and head holding.

^hLearning disability at 2 years of age estimated from the Parent Report of Children's Abilities-Revised (or the Ages and Stages Questionnaires for France only).

Supplemental Table 4. Rates of movement difficulties, in total and by component (based on Movement ABC-2) – Sensitivity analysis without IPW.^a

	Movement difficulties					
	None		At risk		Significant	
	(>15 th percentile)		(6 th -15 th percentile) ^b		(≤5 th percentile)	
	N	%	N	%	N	%
Total ^c	366	47.4	183	23.7	223	28.9
Manual dexterity ^d	332	43.8	162	21.4	264	34.8
Aiming and catching ^d	543	71.5	72	9.5	144	19.0
Balance ^d	492	64.8	130	17.1	137	18.1

Abbreviations: Movement ABC-2, Movement Assessment Battery for Children – 2nd Edition.

^aValues are frequencies (N) and % (excluding missing values) rounded to one decimal; both without the use of inverse probability weighting (IPW) to correct loss to follow-up.

^bAs explained in the Movement ABC-2 manual,²⁴ the 16th percentile is used instead of the 15th percentile to delineate the "at risk of movement difficulties" category.

^cTotal: Movement ABC-2 total score composed of the 3 components (manual dexterity, aiming and catching, and balance).

^dFor the 3 component scores, the total of the n is not necessarily equal to 772 because mainly total scores were imputed when a test-item/a component was missing.

Supplemental Table 5. Association between movement difficulties and sociodemographic, perinatal and neonatal characteristics (Model II) among five-year-old children born extremely preterm – Sensitivity analysis in complete case without IPW, complete case with IPW, and multiple imputed dataset without IPW.^a

	Complete case only Movement difficulties		Complete case + IPW Movement difficulties		Multiple imputed dataset only Movement difficulties	
	At risk	Significant	At risk	Significant	At risk	Significant
	RRR [95% CI]	RRR [95% CI]	RRR [95% CI]	RRR [95% CI]	RRR [95% CI]	RRR [95% CI]
Sociodemographic characteristics						
Maternal age at childbirth (years)						
<25	1.96 [0.89-4.28]	3.06 [1.40-6.67]	2.38 [1.01-5.61]	2.97 [1.30-6.76]	1.45 [0.73-2.89]	2.36 [1.18-4.74]
25-34	REF	REF	REF	REF	REF	REF
≥35	0.66 [0.39-1.12]	1.21 [0.76-1.93]	0.69 [0.40-1.20]	1.14 [0.71-1.86]	0.66 [0.41-1.06]	1.13 [0.71-1.79]
Parental cohabiting status						
Married/Couple/Cohabiting	REF	REF	REF	REF	REF	REF
Single/Other	1.09 [0.59-2.00]	0.89 [0.48-1.65]	1.21 [0.64-2.31]	1.01 [0.53-1.95]	1.29 [0.73-2.27]	1.02 [0.54-1.93]
Maternal educational level						
≤Lower secondary	1.38 [0.70-2.71]	2.75 [1.38-5.49]	1.31 [0.63-2.69]	2.89 [1.40-5.96]	1.22 [0.64-2.30]	2.18 [1.11-4.30]
Upper secondary/Short tertiary	0.85 [0.52-1.38]	1.06 [0.65-1.75]	0.74 [0.44-1.24]	0.94 [0.55-1.59]	0.95 [0.60-1.51]	1.14 [0.69-1.89]
≥Bachelor	REF	REF	REF	REF	REF	REF
Household employment status						
Employed or other situation ^b	REF	REF	REF	REF	REF	REF
At least one parent unemployed	4.81 [2.51-9.22]	2.82 [1.41-5.66]	4.89 [2.45-9.77]	3.45 [1.64-7.23]	3.92 [2.17-7.10]	2.10 [1.05-4.21]
Parity						
Primiparous	1.54 [0.94-2.50]	1.24 [0.79-1.93]	1.65 [0.99-2.76]	1.49 [0.93-2.38]	1.39 [0.89-2.16]	1.44 [0.92-2.26]
Multiparous	REF	REF	REF	REF	REF	REF
Maternal country of birth						
Native-born	REF	REF	REF	REF	REF	REF
Other European country	0.76 [0.28-2.04]	1.59 [0.64-3.94]	0.89 [0.34-2.35]	1.58 [0.61-4.08]	0.92 [0.38-2.23]	1.49 [0.63-3.53]
Non-European country	0.94 [0.47-1.85]	2.52 [1.42-4.49]	0.96 [0.48-1.91]	2.51 [1.40-4.49]	0.63 [0.33-1.19]	2.08 [1.18-3.67]
Perinatal characteristics						
GA (weeks)						
≤24	1.44 [0.62-3.35]	2.10 [0.97-4.54]	1.62 [0.69-3.82]	2.45 [1.09-5.49]	1.19 [0.53-2.69]	2.06 [0.95-4.46]
25	0.98 [0.51-1.88]	2.23 [1.22-4.09]	1.01 [0.52-1.95]	2.34 [1.24-4.42]	1.02 [0.55-1.89]	2.19 [1.23-3.91]
26	0.90 [0.55-1.46]	1.43 [0.84-2.44]	1.00 [0.59-1.68]	1.44 [0.82-2.55]	1.01 [0.64-1.59]	1.43 [0.85-2.40]
27	REF	REF	REF	REF	REF	REF

SGA						
<3 rd percentile	1.80 [0.99-3.27]	1.20 [0.65-2.21]	1.92 [1.03-3.57]	1.22 [0.64-2.32]	1.72 [0.97-3.04]	1.48 [0.82-2.68]
3-9 th percentile	0.99 [0.45-2.19]	1.40 [0.64-3.07]	1.00 [0.43-2.33]	1.54 [0.65-3.65]	0.98 [0.48-1.99]	1.46 [0.71-3.00]
≥10 th percentile	REF	REF	REF	REF	REF	REF
Child sex						
Female	REF	REF	REF	REF	REF	REF
Male	1.89 [1.24-2.87]	3.14 [2.03-4.84]	1.87 [1.21-2.88]	2.85 [1.81-4.47]	1.92 [1.29-2.85]	2.74 [1.81-4.16]
Multiple birth						
Singleton	REF	REF	REF	REF	REF	REF
Multiple	0.63 [0.40-1.00]	0.69 [0.42-1.15]	0.57 [0.36-0.91]	0.65 [0.38-1.12]	0.71 [0.46-1.09]	0.76 [0.46-1.24]
Premature rupture of membranes						
No	REF	REF	REF	REF	REF	REF
Yes	1.37 [0.84-2.23]	1.24 [0.78-1.97]	1.25 [0.75-2.07]	1.20 [0.74-1.95]	1.19 [0.75-1.90]	1.07 [0.66-1.74]
Antenatal corticosteroids						
No	0.37 [0.15-0.88]	0.60 [0.26-1.39]	0.29 [0.12-0.71]	0.51 [0.22-1.19]	0.40 [0.18-0.91]	0.77 [0.33-1.75]
Yes	REF	REF	REF	REF	REF	REF
Congenital anomaly						
No	REF	REF	REF	REF	REF	REF
Yes	0.59 [0.23-1.52]	1.78 [0.81-3.89]	0.48 [0.18-1.26]	1.43 [0.63-3.22]	0.87 [0.36-2.09]	2.97 [1.34-6.55]
Neonatal characteristics						
Severe brain lesions (IVH/cPVL)^c						
No		REF		REF	REF	REF
Yes	1.33 [0.65-2.73]	3.35 [1.86-6.02]	1.49 [0.71-3.12]	4.18 [2.28-7.66]	1.21 [0.60-2.45]	1.82 [0.96-3.43]
Retinopathy of prematurity						
No		REF		REF	REF	REF
Yes	1.23 [0.58-2.63]	0.97 [0.49-1.91]	1.16 [0.53-2.57]	1.04 [0.51-2.12]	1.34 [0.63-2.88]	1.28 [0.65-2.50]
Necrotizing enterocolitis						
No		REF		REF	REF	REF
Yes	1.78 [0.63-4.98]	1.26 [0.47-3.39]	1.42 [0.52-3.90]	0.97 [0.36-2.59]	2.03 [0.74-5.55]	1.59 [0.57-4.46]
BPD						
No		REF		REF	REF	REF
Yes	1.75 [1.04-2.96]	2.46 [1.48-4.09]	1.73 [1.00-2.98]	2.56 [1.49-4.39]	1.83 [1.12-2.99]	2.26 [1.36-3.76]
Postnatal corticosteroids						
No		REF		REF	REF	REF
Yes	1.05 [0.61-1.81]	1.59 [0.93-2.70]	1.01 [0.58-1.76]	1.57 [0.88-2.80]	1.20 [0.71-2.01]	1.84 [1.08-3.14]

Breastfeeding at discharge						
No	1.14 [0.72-1.81]	1.20 [0.76-1.88]	1.12 [0.68-1.82]	1.26 [0.77-2.05]	1.08 [0.70-1.68]	1.06 [0.67-1.67]
Yes		REF		REF	REF	REF
Country (region)						
Belgium (Flanders)	REF	REF		REF	REF	REF
Denmark (Eastern Region)	0.48 [0.18-1.32]	0.66 [0.20-2.12]	0.50 [0.18-1.38]	0.66 [0.21-2.10]	0.40 [0.15-1.07]	0.61 [0.18-2.03]
Estonia (entire country)	0.13 [0.03-0.52]	0.67 [0.23-1.92]	0.11 [0.03-0.46]	0.67 [0.22-2.01]	0.19 [0.05-0.67]	0.85 [0.28-2.60]
France (Burgundy, Ile-de-France, Northern Region)	0.22 [0.09-0.54]	0.24 [0.10-0.57]	0.19 [0.08-0.47]	0.26 [0.11-0.63]	0.21 [0.09-0.49]	0.17 [0.07-0.45]
Germany (Hesse, Saarland)	0.21 [0.06-0.75]	0.53 [0.18-1.57]	0.15 [0.04-0.50]	0.57 [0.20-1.68]	0.31 [0.10-0.95]	0.58 [0.20-1.71]
Italy (Emilia-Romagna, Lazio, Marche)	0.61 [0.25-1.49]	1.61 [0.71-3.66]	0.57 [0.23-1.43]	1.67 [0.71-3.92]	0.61 [0.26-1.44]	1.70 [0.70-4.14]
The Netherlands (Central Eastern)	0.67 [0.27-1.67]	0.26 [0.09-0.78]	0.62 [0.24-1.59]	0.28 [0.09-0.89]	0.58 [0.24-1.40]	0.24 [0.07-0.79]
Poland (Wielkopolska)	0.99 [0.20-4.81]	9.12 [2.67-31.16]	0.75 [0.15-3.81]	7.89 [2.11-29.49]	1.16 [0.23-5.99]	11.69 [2.90-47.07]
Portugal (Lisbon, Northern Region)	0.62 [0.25-1.55]	0.94 [0.38-2.29]	0.48 [0.19-1.23]	0.88 [0.35-2.20]	0.71 [0.29-1.72]	1.16 [0.45-3.03]
The United Kingdom (East Midlands, Northern, Yorkshire and the Humber)	0.67 [0.26-1.72]	3.28 [1.28-8.37]	0.50 [0.19-1.34]	3.28 [1.24-8.67]	0.72 [0.30-1.72]	2.65 [1.01-6.90]
Sweden (Greater Stockholm)	0.13 [0.03-0.64]	0.33 [0.09-1.21]	0.11 [0.02-0.56]	0.34 [0.09-1.33]	0.17 [0.04-0.75]	0.56 [0.15-2.05]

Abbreviations: Movement ABC-2, Movement Assessment Battery for Children – 2nd Edition. GA, gestational age. SGA, small for gestational age. IVH, intraventricular haemorrhage. cPVL, cystic periventricular leukomalacia. BPD, bronchopulmonary dysplasia.

^aValues are relative risk ratios and their 95% confidence intervals (RRR [95% CI]) from multinomial logistic regression models in complete case without inverse probability weighting (IPW), complete case with IPW, and multiple imputed dataset without IPW: adjusted on sociodemographic, perinatal and neonatal factors (Model II); all taking into consideration clustering within multiple pairs, and with country modelled as a fixed effect.

^bOther situations included student, parental leave, home parent and other.

^cSevere brain lesions, defined as having an IVH grade III/IV, and/or a cPVL.

Supplemental Table 6. Association between movement difficulties and sociodemographic, perinatal and neonatal characteristics (Model II) among five-year-old children born extremely preterm – Sensitivity analysis with the use of Movement ABC-2 United Kingdom norms vs Movement ABC-2 national norms.^a

	Movement ABC-2 United Kingdom norms		Movement ABC-2 national norms	
	At risk RRR [95% CI]	Significant RRR [95% CI]	At risk of MD RRR [95% CI]	Significant MD RRR [95% CI]
Sociodemographic characteristics				
Maternal age at childbirth (years)				
<25	1.74 [0.79-3.84]	2.47 [1.15-5.30]	1.79 [0.82-3.91]	2.19 [1.06-4.52]
25-34	REF	REF	REF	REF
≥35	0.71 [0.43-1.17]	1.10 [0.67-1.80]	0.86 [0.52-1.44]	0.95 [0.59-1.54]
Parental cohabiting status				
Married/Couple/Cohabiting	REF	REF	REF	REF
Single/Other	1.42 [0.74-2.75]	0.91 [0.42-1.95]	1.30 [0.68-2.50]	0.91 [0.45-1.82]
Maternal educational level				
≤Lower secondary	1.21 [0.58-2.54]	2.26 [1.01-5.04]	1.08 [0.50-2.33]	1.98 [0.94-4.14]
Upper secondary/Short tertiary	0.87 [0.53-1.45]	1.02 [0.59-1.80]	0.95 [0.56-1.61]	0.88 [0.52-1.46]
≥Bachelor	REF	REF	REF	REF
Household employment status				
Employed or other situation ^b	REF	REF	REF	REF
At least one parent unemployed	3.16 [1.58-6.31]	1.96 [0.87-4.43]	2.03 [0.98-4.21]	2.07 [0.99-4.34]
Parity				
Primiparous	1.50 [0.94-2.42]	1.76 [1.07-2.91]	1.40 [0.86-2.29]	1.73 [1.08-2.76]
Multiparous	REF	REF	REF	REF
Maternal country of birth				
Native-born	REF	REF	REF	REF
Other European country	1.04 [0.44-2.43]	1.50 [0.62-3.61]	0.92 [0.39-2.17]	1.64 [0.71-3.77]
Non-European country	0.54 [0.27-1.08]	1.90 [1.04-3.46]	0.82 [0.44-1.56]	1.64 [0.92-2.91]
Perinatal characteristics				
GA (weeks)				
≤24	1.45 [0.62-3.44]	2.30 [1.03-5.13]	1.67 [0.67-4.16]	2.35 [1.08-5.11]
25	1.10 [0.59-2.07]	2.42 [1.31-4.48]	1.24 [0.66-2.33]	2.02 [1.13-3.62]
26	1.17 [0.71-1.93]	1.34 [0.76-2.36]	1.27 [0.76-2.11]	1.21 [0.71-2.06]
27	REF	REF	REF	REF
SGA				
<3 rd percentile	1.82 [1.00-3.30]	1.59 [0.83-3.04]	1.99 [1.09-3.66]	1.38 [0.76-2.52]
3-9 th percentile	1.02 [0.47-2.18]	1.58 [0.73-3.40]	1.16 [0.52-2.59]	1.80 [0.88-3.71]
≥10 th percentile	REF	REF	REF	REF
Child sex				
Female	REF	REF	REF	REF
Male	1.81 [1.18-2.76]	2.23 [1.42-3.51]	1.78 [1.15-2.77]	2.08 [1.36-3.18]
Multiple birth				
Singleton	REF	REF	REF	REF
Multiple	0.65 [0.42-1.01]	0.78 [0.46-1.33]	0.65 [0.41-1.02]	0.81 [0.49-1.32]
Premature rupture of membranes				
No	REF	REF	REF	REF
Yes	1.14 [0.69-1.88]	1.04 [0.62-1.72]	1.29 [0.78-2.13]	1.18 [0.72-1.93]
Antenatal corticosteroids				
No	0.35 [0.15-0.81]	0.80 [0.33-1.96]	0.42 [0.18-1.01]	0.87 [0.39-1.95]
Yes	REF	REF	REF	REF
Congenital anomaly				

No	REF	REF	REF	REF
Yes	0.69 [0.27-1.76]	2.33 [0.95-5.72]	0.83 [0.29-2.38]	2.15 [0.90-5.13]
Neonatal characteristics				
Severe brain lesions (IVH/cPVL)^c				
No	REF	REF	REF	REF
Yes	1.31 [0.63-2.73]	2.17 [1.14-4.12]	1.69 [0.80-3.61]	2.24 [1.19-4.22]
Retinopathy of prematurity				
No	REF	REF	REF	REF
Yes	1.21 [0.53-2.75]	1.34 [0.66-2.76]	1.35 [0.60-3.05]	1.43 [0.70-2.92]
Necrotizing enterocolitis				
No	REF	REF	REF	REF
Yes	1.54 [0.57-4.19]	1.10 [0.41-2.96]	2.20 [0.77-6.29]	1.11 [0.42-2.97]
BPD				
No	REF	REF	REF	REF
Yes	1.94 [1.13-3.33]	2.54 [1.47-4.40]	1.42 [0.80-2.52]	2.46 [1.48-4.09]
Postnatal corticosteroids				
No	REF	REF	REF	REF
Yes	1.05 [0.61-1.82]	1.94 [1.09-3.44]	0.86 [0.49-1.50]	1.81 [1.08-3.04]
Breastfeeding at discharge				
No	1.01 [0.62-1.64]	0.98 [0.59-1.62]	0.84 [0.51-1.38]	1.00 [0.62-1.61]
Yes	REF	REF	REF	REF
Country (region)				
Belgium (Flanders)	REF	REF	REF	REF
Denmark (Eastern Region)	0.42 [0.15-1.19]	0.66 [0.20-2.21]	0.65 [0.22-1.86]	0.37 [0.12-1.18]
Estonia (entire country)	0.16 [0.04-0.59]	0.85 [0.26-2.82]	0.26 [0.07-0.99]	0.45 [0.14-1.44]
France (Burgundy, Ile-de-France, Northern Region)	0.19 [0.08-0.47]	0.20 [0.07-0.54]	0.38 [0.15-0.94]	0.24 [0.10-0.59]
Germany (Hesse, Saarland)	0.24 [0.08-0.72]	0.64 [0.21-1.97]	0.45 [0.15-1.40]	0.37 [0.13-1.11]
Italy (Emilia-Romagna, Lazio, Marche)	0.56 [0.23-1.35]	1.80 [0.70-4.64]	0.31 [0.12-0.82]	0.48 [0.19-1.19]
The Netherlands (Central Eastern)	0.52 [0.21-1.29]	0.26 [0.08-0.88]	0.66 [0.23-1.88]	0.90 [0.34-2.36]
Poland (Wielkopolska)	0.81 [0.15-4.35]	9.61 [2.09-44.17]	1.38 [0.26-7.44]	5.42 [1.25-23.38]
Portugal (Lisbon, Northern Region)	0.55 [0.22-1.37]	1.15 [0.42-3.17]	0.96 [0.37-2.48]	0.65 [0.25-1.71]
The United Kingdom (East Midlands, Northern, Yorkshire and the Humber)	0.53 [0.22-1.32]	2.46 [0.87-6.92]	0.97 [0.37-2.52]	1.36 [0.52-3.54]
Sweden (Greater Stockholm)	0.14 [0.03-0.67]	0.61 [0.15-2.44]	0.31 [0.07-1.35]	0.33 [0.08-1.29]

Abbreviations: Movement ABC-2, Movement Assessment Battery for Children – 2nd Edition. GA, gestational age. SGA, small for gestational age. IVH, intraventricular haemorrhage. cPVL, cystic periventricular leukomalacia. BPD, bronchopulmonary dysplasia.

^aValues are relative risk ratios and their 95% confidence intervals (RRR [95% CI]) from multinomial logistic regression models with Movement ABC-2 United Kingdom norms (left columns) and Movement ABC-2 national norms (right columns): adjusted on sociodemographic, perinatal and neonatal factors (Model II); both taking into consideration clustering within multiple pairs, with country modelled as a fixed effect, and with the use of inverse probability weighting (IPW) and multiple imputed dataset.

^bOther situations included student, parental leave, home parent and other.

^cSevere brain lesions, defined as having an IVH grade III/IV, and/or a cPVL.