

Decreasing prevalence in cerebral palsies: a multi-site European population-based study, 1980- 2003

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ABSTRACT

AIM: To monitor the trends in prevalence of CP by birthweight (BW) in Europe, 1980-2003.

METHOD: Data were collated from twenty population-based registers contributing to the Surveillance of Cerebral Palsy in Europe database. Trend analyses were conducted in four BW groups: <1000g (ELBW), 1000-1499g (VLBW), 1500-2499g (MLBW) and >2499 g (NBW).

RESULTS: The overall prevalence of CP decreased from 1.90 to 1.77 per 1000 LB, $p<0.001$, with a mean annual fall of 0.7% (95% CI -0.3 to -1.0%). Prevalence in NBW children showed a non-significant trend from 1.17 to 0.89 per 1000 LB ($p=0.22$). Prevalence in MLBW children decreased from 8.5 to 6.2 per 1000 LB ($p<0.001$), but not linearly. Prevalence in VLBW children also declined from 70.9 to 35.9 per 1000 LB ($p<0.001$) with a mean annual fall of 3.4% (95% CI -2.4% to -4.3%). Prevalence in ELBW children remained stable, at a mean rate of 42.4 per 1000 LB.

INTERPRETATION: The decline in prevalence of CP in children of VLBW continues, and confirms that previously reported. For the first time, there is also a significant decline among those of MLBW, resulting in a significant overall decrease in the prevalence of CP

Short title: Prevalence in cerebral palsies

What This Study Adds

- We describe a further decrease in the prevalence of CP in children born of birthweight 1000-1499g in 1980-2003, from that reported previously (1980-1996).
- We report a significant reduction in the prevalence of CP in children of birthweight 1500-2499g.
- For the first time, this has result in a significant decrease in the overall prevalence of CP.

Cerebral palsy (CP) is the most common cause of significant motor impairment in children. It has many determinants, generally classified according to their time of onset; antenatal, perinatal or postnatal.¹ It is commonly perceived to result from multiple interacting factors and events rather than a single cause.² Changes in obstetric and neonatal practices over time have led to the expectation that the likelihood of a child developing CP will also change. In response to this, many areas established population-based registers to monitor CP prevalence, with the aim of relating changes in prevalence to changes in antenatal, perinatal and postnatal care.³

A recent systematic review and meta-analysis estimated the prevalence of CP at 2.11/1000 live births (LB) among children born since 1985. The authors concluded that the prevalence has not changed significantly in recent years; basing their conclusion on recently published studies.⁴ Prevalence estimation from meta-analysis of aggregated data from studies with heterogeneous inclusion and exclusion criteria is less robust than from estimation based on pooled individual data with homogeneous criteria. Furthermore, this study did not assess population changes over time, nor examine time trends within birthweight (BW) or gestational age (GA) specific groups. A recent review comparing prevalence trends, in CP overall and by GA groups from 1970 to 2004, drew on data from different population-based registers world-wide.⁵ However there are many challenges in interpretation differences or similarities when registers do not share the same harmonization methods. To our knowledge, there has been no recent published report of prevalence trends using pooled individual data from multisite population-based registers using an agreed data protocol.

The Surveillance of Cerebral Palsy in Europe (SCPE) network was formed in 1998. It established a common database of individual data on those with CP with data contributed by population-based CP registers across Europe using agreed classifications, definitions, and shared quality assurance processes. It has previously described trends in CP prevalence by BW and GA groups in the pooled dataset, demonstrating a decline in CP prevalence among children with BW below 1500g, from 60.6/1000 LB in 1980 to 39.5/1000 LB in 1996.⁶ For children born between 32 and 36 weeks, the prevalence declined in a non-linear pattern between 1980 and 1998. The peak prevalence observed in 1983, was 12.2/1000 LB decrease thereafter. No significant change in prevalence has been reported in children with moderately low BW (MLBW, 1500-2499g).⁷ Similarly, no significant change in the prevalence for children born with a normal BW (NBW, >2499g), has been reported, with a mean prevalence of 1.14/1000 between 1980 and 1998.⁸

There has been no recent, large-scale, population-based study exploring time trends in CP prevalence. The study reported here aims to address this by analysing data on CP by BW groups in Europe among children born in 1980 to 2003.

METHOD

Definition and classification

All registers contributing to the SCPE network are population-based, covering either a region or a whole country in Europe. Data collection and harmonisation methods have been previously reported.^{9, 10} CP is defined as a group of permanent, but not unchanging, disorders

of movement and/or posture and of motor function, due to a non-progressive interference, lesion, or abnormality of the developing/immature brain. Progressive disorders or non-cerebral diseases leading to a loss of motor function are excluded. The diagnosis of CP should be confirmed at around the age of five. As previously described, subtypes of CP were defined as unilateral spastic (US-CP), bilateral spastic (BS-CP), dyskinetic or ataxic.¹¹ Severity of disability was defined, using available data from participating registries on intellectual quotient (IQ), Gross Motor Function Classification System (GMFCS), and walking ability, and classified as either moderate-to-severe (children with IQ < 50 or GMFCS level III-V or not able to walk without assistive devices) or mild (children with IQ ≥ 50 and either GMFCS level I-II or able to walk without assistive devices). Hierarchical trees developed by the SCPE network were used to operationalize the inclusion and exclusion criteria and the classification of CP subtypes to ensure consistency across registers.^{10, 11} To further enhance data harmonization across countries, SCPE developed a standardized data collection form and a reference and training manual CD-ROM translated into 12 languages.¹² For a full description, go to <http://www.scpenetwork.eu>.

Study population

In total, 26 population-based registers provided anonymized individual data to the SCPE common database for the whole or part of the period 1980–2003, representing 15 090 children with CP (Figure 1). The children were categorized in four BW groups: <1000g (ELBW), 1000–1499g (VLBW), 1500–2499g (MLBW) and >2499g (NBW). Inclusion criteria were as follows: children whose mothers lived in an area covered by a register at the time of delivery; (except for Grenoble, France, where important migration patterns led us to include the children living in the area at the time of registration instead); children registered in registers with annual population data for LB, stratified by BW, available for some or all of the study period. Exclusion criteria were: children with a post-neonatal onset, children from registries with a poor level completeness, children from registries with data on only one CP subtype or from registers with only one year of registration data. Data on neonatal deaths stratified by BW were provided by 10 registers and used in the results as an estimate for neonatal mortality in Europe during the study period. Data from a further six registries unable to provide such data were excluded.

SCPE network has no specific ethical approval as it only gathers anonymized data. Each register had its own ethical approval that follows the legislative rules of its country.

Statistical analysis

To study changes in BW distribution of children with CP, we compared three time periods: 1980–1987; 1988–1995; 1996–2003, using the Chi-squared test adjusted on register effect to take account of the fact that the number of contributing registers differed between the periods.

Prevalence rates were calculated and are presented throughout the article per 1000 LB for all cases and for each BW group. Poisson regression was used to investigate trends in prevalence of CP. Poisson models were adjusted with offset terms to account for denominators. As different registers provided data covering different time periods, we followed several steps. Firstly, we analyzed trends in prevalence within each register. Secondly, we used pooled data to estimate trends in Europe. The initial model contained individual birth years. Addition of a term for register allowed for testing of a register effect. This model allowed us to study the

trends in prevalence rates including data from registers unable to contribute data for the entire study period. Adding an interaction term between register and birth year provided a test for heterogeneity of trends between registers, using the median trend as the reference trend. In case of significant interaction, the register(s) responsible for interaction was(were) excluded. We also tested non-linearity of the trends using orthogonal polynomial terms for birth years up to third order. Likelihood-ratio Chi squared tests were used to compare nested models. To analyze the trends in prevalence, we also fitted mixed effects models. These yielded similar results as those presented in this article, i.e. without random effects.

The threshold selected for overall analyses was $p < 0.005$. The threshold for analyses of individual registers data was $p < 0.05$. The figures show the birth prevalence of all CP and of moderate-to-severe CP in each BW group. Curves were smoothed using locally weighted scatterplot smoothing.¹³ Statistical analyses were performed using Stata Statistical software (version 12.0, Stata Corp., College Station, TX, USA).

RESULTS

A total of 10 756 children with CP from 20 registers covering a population of 5 382 785 inhabitants were included in the analysis, (Table I). The prevalence of CP in 18 registers decreased linearly from 1.90 (99% CI 1.57–2.28) in 1980 to 1.77 (1.57–1.99) in 2003, $p < 0.001$, a mean decrease of 0.7% per annum (95% CI -0.3 to -1.0%). Two registers (Slovenia and Portugal) showed significantly different trends from the others (p for interaction < 0.001), each with a decrease more pronounced than the other registers. When restricting the analysis to the children with moderate-to-severe CP, there was no significant interaction, and a significant decline in prevalence was observed across the 20 registers, from 0.98 (99%CI 0.75–1.26) to 0.72 (0.61–0.83), $p < 0.001$, a mean annual fall of 1.8% per annum (95% CI -1.2 to -2.3%).

Figure 2 shows the BW distribution among children with CP across three time periods. In the most recent time period (1996 to 2003) the proportion of both NBW and ELBW increased, with a concomitant decrease in those of MLBW ($p < 0.001$). Within the ELBW group, the proportion of those < 750 g increased from 12% (14/117) in 1980–1987 to 33% (125/375) in 1996–2003 (p for trend = 0.002), and within the VLBW group, 48% (729/1530) had a BW between 1000–1250g with no significant change over time ($p = 0.91$). The distribution of CP subtype by BW (Table II) showed a significant change over time only among spastic group, with a decrease in the proportion with bilateral spastic CP and a concomitant increase in the proportion with unilateral spastic subtype in both MLBW and NBW groups ($p < 0.001$).

Data on IQ were missing for 1760 children (16.4%) and GMFCS/walking for 597 children (5.6%). Data on severity were missing for 1201 children (11.2%). By period, severity was missing for 10.5% of children in 1980-1987, 7.8% of children in 1988-1995 and 13.8% of children in 1996-2003.

The overall prevalence of CP among NBW children was 1.13 (5 492/4 872 419), with a non-statistically significant decrease from 1.17 (99%CI 0.90–1.49) to 0.89 (0.77–1.03), $p = 0.22$

(Figure 3a). The peak prevalence was 1.34 (1.08–1.64) in birthyear 1983. The moderate-to-severe CP subgroup also showed a non-statistically significant decrease, from 0.52 (0.34–0.74) to 0.39 (0.31–0.48), $p=0.02$. During the same period, neonatal mortality for NBW children decreased significantly from 1.65 (CI 1.33–2.03) to 0.89 (0.75–1.05) per 1000 LB ($p < 0.001$). Among NBW children, the prevalence rate of children with bilateral spastic CP decreased significantly, with a mean annual fall of 1.4% per annum (95% CI -0.7% to -2.1%), $p < 0.001$, falling from 0.64 (0.49–0.83) to 0.35 (0.29–0.42). The prevalence rate of children with unilateral spastic CP increased significantly but not linearly, $p=0.003$. The peak prevalence was 0.55 in 1991 (0.44–0.66), followed by a plateau until 2000 and then a tendency to decrease.

The overall prevalence of CP among MLBW children was 9.4 (2 336/249 393). It fell from 8.5 (99%CI 5.4–12.7) to 6.2 (4.9–7.8), $p < 0.001$, over the study period, although not linearly with a peak prevalence in 1983 (Figure 3b). For the moderate-to-severe CP, the prevalence decreased from 4.5 (2.3–7.7) to 3.2 (2.3–4.4), $p < 0.001$; but again this was not linear, with a peak prevalence in 1988. During the same period, neonatal mortality for MLBW children decreased from 19.6 (14.7–25.6) to 9.3 (7.4–11.4) per 1000 LB ($p < 0.001$). Among MLBW children, the prevalence rate of children with bilateral spastic CP decreased significantly but not linearly ($p < 0.001$). The peak prevalence was 9.3 (7.0–12.2) in 1983 and the lowest 3.7 (2.9–4.6) in 2003. The prevalence rate of children with unilateral spastic CP did not change significantly ($p=0.54$) over the period with a mean of 2.4 (2.2–2.6).

The overall prevalence of CP among VLBW children was 52.1 (1507/28 900). It showed a linear decline from 70.9 (99%CI 41.7–110.9) to 35.9 (26.6–47.2), $p < 0.001$, with a mean decrease per year of 3.4% (95% CI -2.4 to -4.3%) (Figure 3c). For the moderate-to-severe CP, the prevalence fell from 48.1 (24.7–83.0) to 17.1 (10.9–25.4), $p < 0.001$ with a mean decrease per year of 5.2% (95% CI -3.9 to -6.4%). During the same period, neonatal mortality for VLBW children fell from 184.8 (137.3–240.1) to 45.0 (33.4–59.0) per 1000 LB ($p < 0.001$), i.e. a 75% reduction.

The overall CP prevalence for ELBW children was 42.4 (764/18 008), ranging from 40.9 (99%CI 12.1–97.3) in 1980 to 38.2 (26.0–53.8) in 2003 (Figure 3d). There was no significant trend, ($p = 0.84$) with non-linear increase until 1992. For the moderate-to-severe CP, the prevalence was also stable with a mean of 20.0 (SD 7.0). From 1980 to 2003, neonatal mortality for ELBW children decreased from 632 (531–725) to 316 (279–345) per 1000 LB ($p < 0.001$).

Eight registers were active during all three time periods (Grenoble/ France, Cork/Ireland, Belfast/United Kingdom, Göteborg/Sweden, Dublin/Ireland, Newcastle/United Kingdom, Tonsberg/Norway, Rome/Italy) and collected data on 7464 of the children included in the SCPE common database. The analyses of trend restricted to these eight registries showed similar results as those found when using data from all registers participating in SCPE.

DISCUSSION

The analysis presented here provides an updated estimate of the prevalence of CP in Europe for the birth years 1980-2003, and is the first paper to show a significant decrease in both the

overall prevalence of CP within Europe, and in the prevalence of moderate-to-severe CP. It shows a significant reduction in the prevalence of CP among children of birthweight 1500 to 2499 g (MLBW), and demonstrates a further reduction in the prevalence of CP in children with BW 1000-1499 g (VLBW) compared with that reported previously (1980-1996).⁶ Although CP prevalence is still considerably higher in the lower BW groups, these findings provide important feed-back to obstetricians and neonatologists, and for child health systems in general, particularly as the decreased prevalence of CP among VLBW and MLBW infants accompanies a reduction in neonatal mortality of at least 50% across Europe. Although similar significant reductions are not also seen in NBW and ELBW groups, they are not increasing. Thus the work of SCPE, particularly when set alongside a continued decline in neonatal mortality rates in these groups and a more important decline in the moderate-to-severe group, provides an encouraging message to both clinicians and parents. Among those of ELBW, the group considered at greatest risk of CP, the proportion of babies born with a BW of less than 750g, increased significantly from 12 to 33%, which may in part explain the lack of reduction in the prevalence of CP in this group.

Epidemiological data from other countries and continents

To our knowledge, in the United States, there are no published data of recent trends in CP prevalence by birthweight groups. The most recent report from The Metropolitan Atlanta Developmental Disabilities Surveillance Program (MADDSP), which monitors trends in childhood developmental disabilities, indicates a CP prevalence rate of 3.1 per 1000 8-year-old children in 2008,¹⁴ showing little change from the rate reported in 2002.¹⁵ Using data from the National Health Interview Surveys, CP prevalence showed a small increase from 3.9 to 4.3 per 1000 (1997 to 2002).¹⁶ However in this study, information on CP was parent-reported, without confirmation from a clinical source.

A follow-up study of extremely preterm babies (<28 weeks) born in Alberta, Canada reported similar CP prevalence and neonatal mortality rates to those reported here,¹⁷ but data on less premature babies is not available for this population. In another Canadian province (Nova Scotia), while mortality rates declined between 1993 and 2007, CP rates in children born <31 weeks showed steady increase until period 1998-2002 followed by a decrease.¹⁸

SCPE data are best compared with data from the Australian Cerebral Palsy Register (ACPR). The ACPR monitors CP prevalence over time, using data from several Australian registers, and uses inclusion and exclusion criteria and a CP classification system similar to those used by SCPE. Their recent report,¹⁹ on children born 1993-2006, showed similar trends in BW-specific CP prevalence, although the decrease in the VLBW group was only observed from birthyear 1998. They also show a declining prevalence in the ELBW group, although this may reflect a different birth weight distribution within this ELBW group. Thus, data from two different continents with similar health care systems, and using similar methods suggest that the observed change in CP prevalence, even on a general level, is unlikely to be due to chance.

Neonatal care

Over the period of study included in this paper, there have been many critical developments implemented in neonatal care. For very preterm born children, the 1990s saw an increasing use of steroids, in both the antenatal and postnatal period (until recommendations from paediatric academies and societies lead to a decline in their postnatal use.)²⁰ Other important changes include the introduction of surfactant, and improvement in the management of nosocomial infections.^{21, 22} Overall, it is clearly recognized that these changes have led to a reduction in both mortality and impairment.^{23, 24} However among ELBW infants, although the evolution of neonatal practice has had a significant impact on neonatal mortality, the impact on reduction of impairment is less evident. The results of the Epicure studies demonstrated that 20% of all babies born at 22 -25 weeks gestation in 2006 had a severe disability, and that this proportion remained unchanged since 1995.²³ For term-born children, the introduction of hypothermia treatment for hypoxic-ischemic encephalopathy after severe asphyxia is clearly a milestone in the care of these children. There is increasing evidence that its use is resulting in a decrease not only in mortality but also in CP.^{25, 26} This treatment is now being used more widely, thus a potential reduction in CP prevalence among those of NBW group relating to this treatment would not yet be reflected in our analyses, which covered only birth years until 2003.

Pathogenetic factors

The global view, of an unchanging overall CP prevalence, has led in recent years to a discussion of genetic factors, and whether they may play a more important role in the pathogenesis of CP than previously considered.²⁷ However, several systematic reviews on magnetic resonance imaging (MRI) findings in children with CP indicate that brain maldevelopments, which may be due to monogenetic diseases, only account for approximately 10% of pathology in children with CP.^{28, 29, 30}

These reviews report that the most prevalent imaging findings among those with CP, accounting for 50 – 60% of cases, were white matter lesions such as periventricular leukomalacia (PVL) or sequelae of haemorrhage. They are typically lesions of the more immature brain³¹ and are especially seen in preterm born children with CP (e.g. in around 90%). From hospital-based studies, there is evidence for a decrease over time in PVL.³² van Haastert et al. described a decrease in cystic PVL of more than 50% between birth periods 1990-93 and 2002-05. The most significant decrease (ten-fold) was seen in the severe form, i.e. cystic PVL III.³³ In contrast to PVL, there is no clear evidence for a decrease of severe intraventricular haemorrhage (IVH) in the preterm infant during the same time period.^{34, 35} PVL is typically bilateral, thus, when it affects the motor tracts, it usually gives rise to BS-CP.³⁶ In contrast, severe IVH or haemorrhagic infarction usually have a unilateral impact on motor tracts and, thus, give rise to US-CP.³⁷ These data also suggest that on a population basis, a decrease of CP in preterm born children, especially BS-CP, could be anticipated. Indeed, already our earlier papers have suggested this,^{4, 5} now confirmed in the data until birth year 2003, presented here.

The MRI findings in NBW children with CP are more heterogeneous.²⁸⁻³⁰ Findings suggestive of a prenatal origin of CP, e.g. maldevelopments of the brain or white matter lesions are predominant (around 15% and 20% respectively). Patterns that are compatible with an origin around the term account for around 30%. These include infarcts, where there is no evidence that peri- or neonatal care would influence their occurrence, and lesions

associated with hypoxia-ischemia following asphyxia and neonatal encephalopathy. The latter lesions arising in less than 20% of NBW children with CP are the only ones where neonatal care, such as hypothermia treatment could be expected to have an impact on CP prevalence. Thus, expectations for a change in CP prevalence, relating to changes in the neonatal management of such infants, will necessarily only address a small part of prevalence observed in term born children. It will be interesting to note any changes in the prevalence of CP in this group in the future. For some factors associated with CP among children born at term, i.e. non CNS abnormalities, placental status, young maternal age, socio-economic status, there are still inconsistencies in the literature,^{38, 39} and more population based studies on larger number of children should be performed, with an international collaborative work allowing for meta-analysis of these factors. It has to be recognized, however, that in nearly one third of children born at term it is reported that no specific risk factors were present, i.e. much more often than among children born preterm (9%).⁴⁰

Methodological considerations

The data used for this analysis were provided by 20 population-based registers from Europe, all members of the SCPE network, with a long history of harmonising data, and sharing data collection methods and inclusion/exclusion criteria.¹⁰ Robust methods for analysing multi-centre data and identifying 'outliers' were used. In addition, confidence in the results presented here is enhanced by the fact that the same trends were observed when restricted to the group of children with moderate-to-severe CP. Although the severity was not possible to assess for 11% of the children; this is unlikely to have biased our results. Indeed the lowest percentage of missing was seen in 1988-1995 and we observed a linear decrease in the moderate-to-severe prevalence rate.

The time lag between the last birth cohort included in the analysis and the publication date of this paper is due to the age of confirmation of the diagnosis of CP and the practice of registration of CP in epidemiological studies to delay registration until aged 4-5. Further delay occurs due to the stringent data validation procedures established at both the individual register level and at SCPE Central registry level. The unavailability of information on live birth denominators by birth weight group in some of the administrative areas covered by the individual registers prevented performing the inclusion of all SCPE network registries in this analysis. The lack of centre-specific information for live births denominators by gestational age has made analysis by gestational age groups unfeasible at this stage.

CONCLUSION: Continued collaboration of registers within the SCPE network has made it possible to demonstrate time trends in CP prevalence. CP prevalence has decreased in children born with moderately and very low birthweight, even in the presence of decreasing neonatal mortality. This paper has shown, for the first time, a decrease of the overall prevalence of CP, with a decrease of almost 2% per annum in moderate-to-severe CP. This paper has also shown how data on neonatal mortality and the prevalence of CP can improve understanding of the impact of improvements in neonatal care. The introduction of a method to systematically record the results of brain imaging in children with CP may help to further understand mechanisms behind the changes in prevalence.

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Table I. Number of children with CP and live births in the European registers included in the study.

Location of register	Available birth years	Number of CP cases	Number of live births
Grenoble, France	1980-2003	589	337 919
Edinburgh, United Kingdom	1984-1989	679	389 338
Cork, Ireland	1986-1998	185	100 541
Belfast, United Kingdom	1981-2003	1223	549 505
Göteborg, Sweden	1980-2003	1011	498 550
Dublin, Ireland	1985-2003	785	385 438
Newcastle, United Kingdom	1980-2003	1212	527 686
Liverpool, United Kingdom	1980-1989	658	292 004
Copenhagen, Denmark	1980-2003	2374	1 050 822
Rome, Italy	1983-1998	85	39 270
Tonsberg, Norway	1991-2003	668	421 312
Bologna, Italy	1991-1996	59	37 255
Galway, Ireland	1990-1998	98	66 475
Madrid, Spain	1991-1999	93	54 851
Ljubljana, Slovenia	1999-2003	195	87 474
Lisbon, Portugal	2001-2003	514	339 870
Riga, Latvia	2000-2003	46	24 467
Pecs, Hungria	1999-2003	95	45 053
Reykjavik, Iceland	1998-2003	57	24 876
Innsbruck, Austria	1990-2003	130	110 079
Total	1980-2003	10 756	5 382 785

Table II. Type of cerebral palsy according to birth weight of children between 1980 and 2003

Type of CP	1980-1987 <i>n</i> (%)	1988-1995 <i>n</i> (%)	1996-2003 <i>n</i> (%)	<i>p</i> *
BW<1000g (ELBW), n=697				
Spastic	106 (90.6)	191 (93.2)	339 (90.4)	0.22
BS-CP or bilateral	73 (62.4)	141 (68.8)	241 (64.3)	0.49
US-CP or unilateral	32 (27.3)	49 (23.9)	98 (26.1)	
Dyskinetic	4 (3v4)	8 (3.9)	13 (3.5)	0.76
Ataxic	5 (4.3)	2 (1.0)	17 (4.5)	0.86
Unknown	2 (1.7)	4 (1.9)	6 (1.6)	
BW 1000-1499g (VLBW), n=1530				
Spastic	414 (92.2)	423 (94.6)	590 (93.1)	0.17
BS-CP	324 (72.2)	338 (75.6)	452 (71.3)	0.08
US-CP	90 (20.0)	85 (19.0)	136 (21.4)	
Dyskinetic	25 (5.6)	19 (4.2)	27 (4.3)	0.13
Ataxic	7 (1.6)	3 (0.7)	5 (0.8)	0.84
Unknown	3 (0.7)	2 (0.4)	12 (1.9)	
BW 1500-2499g (MLBW), n=2404				
Spastic	658 (91.6)	677 (92.1)	867 (91.2)	0.11
BS-CP	492 (68.5)	494 (67.2)	592 (62.2)	<0.001
US-CP	164 (22.8)	182 (24.8)	273 (28.7)	
Dyskinetic	34 (4.7)	41 (5.6)	46 (4.8)	0.53
Ataxic	12 (1.7)	10 (1.4)	19 (2.0)	0.04
Unknown	14 (1.9)	7 (0.9)	19 (2.0)	
BW≥2500g (NBW), n=5512				
Spastic	1176 (82.1)	1383 (84.1)	1995 (82.0)	0.22
BS-CP	680 (47.4)	718 (43.6)	1002 (41.2)	<0.001
US-CP	495 (34.5)	654 (39.8)	989 (40.6)	
Dyskinetic	121 (8.4)	147 (8.9)	264 (10.8)	0.22
Ataxic	82 (5.7)	92 (5.6)	127 (5.2)	0.76
Unknown	38 (2.6)	23 (1.4)	48 (2.0)	

Abbreviation: BW (Birth weight), BS-CP (Bilateral spastic cerebral palsy); US-CP (Unilateral spastic cerebral palsy)

**p* for trend adjusted on registers (spastic vs others known; BS-CP vs US-CP among spastic; Dyskinetic vs others known; Ataxic vs others known)

FIGURE CAPTIONS

Figure 1. Flow chart

Figure 2. Birth weight distribution of children with CP born between 1980 and 2003 in European registers.

Figure 3a. Prevalence rate of cerebral palsy for children born with a birthweight ≥ 2500 g, per 1000 live births.

Figure 3b. Prevalence rate of cerebral palsy for children born with a birthweight between 1500 and 2499g, per 1000 live births.

Figure 3c. Prevalence rate of cerebral palsy for children born with a birthweight between 1000 and 1499g, per 1000 live births.

Figure 3d. Prevalence rate of cerebral palsy for children born with a birthweight below 1000g, per 1000 live births.