

Cerebral Palsy Registries

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Cerebral palsy (CP) registers appear to be appropriate tools for answering questions regarding the prevalence and characteristics of this common childhood disability. Registers are population databases issuing from multiple sources, relying on a clear definition and inclusion and exclusion criteria of CP, and requiring a mix of skills with the collaboration of obstetricians, pediatricians, and epidemiologists. In Europe alone there are 18 different CP registers or population data collections on CP, and collaborative research efforts exist through a European network. Data collection on CP has also been done in Australia (register), the United States (surveys), and Canada (register). Beside monitoring trends, other public health contributions of CP registers might be to reduce the frequency of CP and to improve the quality of life of children with CP. CP registers are useful to clinicians by enabling them to identify subgroups of children requiring specific etiologic investigations, and also to provide more accurate information to the parents of children with CP.

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FOR A long time, perinatal mortality rate has been widely used as a main outcome measure in assessing standards of perinatal care. Perinatal care, including both obstetric and neonatal care, has changed considerably since 1950. These changes have been associated with a decline in mortality rates, including in recent years the decreasing mortality rate in newborns with birthweight <1500 g.¹ However, many believe that mortality rate no longer accurately reflects the standard of perinatal care given.^{2,3} Moreover, as a direct consequence of the decreasing infant mortality, the health status of surviving children has become a “new” health priority.

Studies looking at changes in measures of childhood morbidity that are linked or assumed to be linked to perinatal practice have not shown a parallel decrease in morbidity rates as compared with mortality rates.⁴⁻⁶ Obstetricians, neonatologists, and pediatricians perhaps have been too optimistic in expecting a similar decrease. Does better obstetric care and neonatal care necessarily lead to less neurologic impairment? This has not been shown in studies of the prevalence of cerebral palsy (CP)

in term and near-term infants,⁷ whereas for low-birthweight infants the results of different recent studies are not always concordant.⁸ Some authors believe that the new characteristics of the at-risk very-low-birthweight (<1500 g) survivors—that is, increasing numbers of tiny babies—have been responsible for the flattening rates of adverse outcome during the period 1975 to 1990.⁹

CP is defined as “a disorder of movement and/or posture and of motor function, permanent but not unchanging, due to a non-progressive lesion or abnormality of an immature brain.”³³ Over the past decade, the incidence of CP in Europe is 2/1000 children.¹⁰ CP constitutes 67% of the severe motor disabilities in childhood. In terms of etiologic factors, CP had been considered to have the greatest quantitative link with perinatal conditions. However, based on results of more recent studies using newer imaging techniques and genetic and metabolic investigations, it is now believed that perinatal factors do not play as large a part in the etiology of CP as was previously thought.¹¹ Other childhood disabilities (eg, sensorial, intellectual, or psychiatric disorders) might also have a link with perinatal conditions, but to a lesser extent.¹²

The impact of changing care on morbidity is not entirely clear. Are childhood disabilities more or less frequent now than before? Are these disabilities more severe now than before? To be able to answer these important questions, prevalence rates of CP must be monitored. This can be done most appropriately by establishing regional CP registers.

DESIGN OF REGISTERS

The latter half of the twentieth century brought increasing growth in the number of registers and databases set up to record and monitor a diversity of diseases for a range of purposes. The numbers of

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such registers have escalated with the steady improvements in information technology.

Many hospitals, especially those that are centers of excellence, have set up databases. Initially these databases were created for administrative purposes, for example, keeping track of patients seen and facilitating follow-up contact. From this beginning it was a short step to using the databases to identify cases for case-control studies. It quickly became obvious that the inclusion of additional medical information could transform such databases into a rich source of data to use in research.

These databases are particularly useful for assessing the effectiveness of different treatments and technologies (eg, surfactant, antenatal/postnatal corticosteroid treatment); however, they do have their limitations. Such databases are more accurately known as “clinical databases.” Case selection is biased by several factors, including whether potential subjects are referred by a physician, whether they can afford the time and expense to travel, whether they feel well enough to travel/ill enough to make a journey worthwhile, and whether or not highly specialized care is required (eg, for very-low-birthweight infants). Due to such biases, clinical databases may not accurately reflect the prevalence of disease in a population.

Registers also hold databases of patients with the disease/disorder of interest, but are distinct from clinical databases in that cases enrolled in a register are drawn from a clearly defined denominator population rather than from hospital(s). CP registers usually use the number of live births or neonatal survivors of a defined geographical area as their denominator population. This means that cases will be selected by residence within a defined catchment area at birth. In this way prevalence rates can be calculated for the population and risks related to the characteristics of the cases. The aim of a register should be to identify all cases within the geographical population regardless of their particular need for hospital treatment or other ongoing support. There is typically great variability in the ways in which cases are collected (eg, active/passive notification, with or without child examination) and in the skill of the professionals completing and coding the data forms.

Certain characteristics have been identified as being associated with successful CP registers:¹³

- At the outset, the purposes for which the register is designed should be clearly defined and should be seen as such by the general public. The

purpose may be, for example, monitoring trends, planning services, or evaluating care, either leading or not leading to specific studies. However, the stated purpose might change over time; thus, it is also important to bear in mind that with changing needs and technologies, the data that need to be collected may also change (eg, magnetic resonance imaging results for children with CP).

- A CP register must collect data from different sources in a geographically defined area (eg, county, region, country) to ensure accuracy of data collection. The completeness of ascertainment must be checked through specific studies, and/or a statistical method (ie, using capture-recapture methods).
- A clear definition of CP, with inclusion and exclusion criteria, must exist. Also, the data collection must allow the evaluation of the disorder’s severity. This might involve applying a threshold severity at which ascertainment can be considered more complete. A standard form must be used for describing the clinical features, severity, and other impairments.
- Population denominator data must be available for the catchment area, for example, live births per birthweight, perinatal mortality rates, and information on population migration (ie, moves into and out of the defined catchment area).
- Expertise in the areas of obstetrics, pediatrics, epidemiology, neurology, and rehabilitation is necessary to produce an effective and efficient CP register. Thus a multidisciplinary approach must be encouraged.

The benefits of having a register in place will not be apparent in the short term. For a relatively rare disorder like CP, a number of years need to pass to ensure that changes in prevalence rates are indicating a real trend rather than random fluctuations. Moreover, the evolutionary nature of CP also adds a significant time delay; the diagnosis may not be accurately made nor be definite until the child’s fifth birthday. Once a CP register has been established, accurate data on the prevalence of CP within a region may not be available for at least 5 years. Stable funding is necessary to ensure continuous data collection over a prolonged period to reliably monitor trends. Ethical committee approval for the establishment of the register is also required. The issues relating to parents consenting to the inclusion of their child’s details on the register must be considered. Parents and the chil-

dren included on the register have a right to access information about the register.

REGISTERS IN EUROPE

The first CP registers in Europe were started in Sweden (1954), England (1966) Ireland (1966), and Denmark (1950),¹⁴⁻¹⁷ with the aim of monitoring trends and describing clinical types of CP children. Information from these registers first alerted the scientific community that, in the pre-neonatal intensive care era (1970s), a drop in perinatal mortality rates was not necessarily associated with a parallel drop in perinatal morbidity rates. Subsequently, registers have been established in many other countries. At present, in Europe alone there are 18 centers in which data on children with CP have been collected (through a register or population-based survey) in a population-based area (Table 1). In most of these centers, data collection is ongoing; in others, data were collected for a limited time only.

Because CP is actually an umbrella term encompassing a variable group of disorders,³⁰ determining which children to include in these CP registers proved challenging.^{31,32} To allow comparative studies and to facilitate international research collaboration, it became essential to harmonize definitions and inclusion/exclusion criteria. In Europe this goal was achieved through the establishment of a network, Surveillance of Cerebral Palsy in Europe (SCPE), in 1999.³³

Registers may also need to collaborate if specific risk factors for subgroups of children with CP (eg, defined by birthweight <1000 g) are being studied, because numbers on any one register will be insufficient. Unless there is a large collaborative effort, results of smaller studies may be inconclusive.³⁴

REGISTERS OR GEOGRAPHICAL DATA COLLECTION OUTSIDE EUROPE

An important CP register was established in Western Australia, with the first birth year cohort (1956) registered in 1975.³⁵ As a result of the availability of neonatal intensive care data and a complete perinatal database in the same area, the team working with this register has contributed greatly to the study of the etiology of CP.³⁶ This register has now expanded to cover the southern and northeastern areas of Australia, with a population covered of more than 100,000 live births per year.

No CP registers have yet been established in the

United States, but two different population-based surveys on CP and childhood disabilities have been published: the Metropolitan Atlanta Developmental Disabilities Surveillance Programme (MADDSP) study in the Atlanta region, which started to register CP children born in 1981 and is also registering children with other impairments,³⁷ and the Northern California Cerebral Palsy Project (NCCPP), which initially focused on children born between 1983 and 1985.³⁸ A large part of the research work from this survey was dedicated to the etiology of CP³⁹ and also to life expectancy in CP children.⁴⁰ Then a similar survey was repeated in the same area on particular subgroups of CP children born from 1988.⁴¹

CP registers are planned in the near future elsewhere, including Canada's Quebec Province and Spain. In addition, there have been some recent attempts to assess the prevalence of CP in developing countries. In China, for example, a low prevalence was observed, without obvious explanation.⁴²

CONTRIBUTION OF CP REGISTERS FROM A CLINICIAN'S POINT OF VIEW

A register never should be an endpoint in itself, but rather should serve as a useful resource to the healthcare community, the child, or the family. The establishment of a CP register should help to focus the knowledge and ideas of a group of professionals that may include obstetricians, pediatricians, pediatric neurologists, statisticians, nurse specialists, and therapists.

A robust dataset allows clinicians and researchers to investigate possible etiologic factors in CP. For many years, the only factors investigated were those surrounding the complications of labor and delivery, but other factors to consider include genetic causes, abnormalities in fetal growth patterns, brain malformations, and the complications of prematurity.

Advances in genetics and neurobiology have allowed clinicians to diagnose many children who would otherwise have gone undiagnosed. A registry can allow rapid identification of subgroups of children for whom these new diagnostic tools might be especially useful, and might also help exclude a diagnosis of CP (eg, gene duplication in Pelizaeus-Merzbacher disease).⁴³

Communicating accurate information to parents is more important now than ever before. A register can serve as a crucial resource for clinicians to help

Table 1. Data Collection on Children With CP in Europe: Register (R) or Population-Based Survey (S)

Reference number	Name, city, country	First birth cohort registered	Population covered (live births/year)	Age at registration	Comments
14	Western Sweden Cerebral Palsy Register, Goteborg, Sweden	1954 ongoing	20,000	4–8 years	(R)
15	Mersey Region Cerebral Palsy Register, Liverpool, U.K.	1966 ongoing	25–30,000	5 years and later reassessments	(R)
16	Southern Ireland Cerebral Palsy Register, Cork, Ireland	1966 ongoing	8–10,000	3 years; reassessed age 5 years	(R)
18	Bilateral Spastic Cerebral Palsy in SW Germany, Tubingen, Germany	1973–1986	17,000	3–16 years	(S) Registration stopped (temporarily?).
19	Cerebral Palsy Register in Eastern Denmark, Copenhagen, Denmark	1971 ongoing	30,000	5 years at least	(R) Expanding case registration to a wider area
20	CRC Cerebral Palsy Register, Dublin, Ireland	1976 ongoing	18–25,000	4–10 years	(R)
21	Register of Childhood Impairments, Toulouse, France	1976 ongoing	10,000	6–16 years then 5 years	(R) Started as a population-based survey.
11	RHEOP (Registre des Handicaps de l'Enfant et Observatoire Perinatal), Grenoble, France	1980 ongoing	14,000	7 years, with assessment at 5 years	(R) RHEOP also registers other children disabilities registered.
8	Oxford Register of Early Childhood Impairments, Oxford, UK	1984 ongoing	35,000	3 years provisional and 5 years final	(R) ORECI also registers sensorial deficiencies.
22	Scottish Register of Children with a Motor Deficit of Central Origin, Edinburgh, UK	1984 ongoing	60,000	3 years	(R) No more cases being registered.
23	Central Italy Cerebral Palsy Register, Roma, Italy	1983 ongoing	3,800	5 years	(R) Expanding case registration to a wider area.
24	Northern Ireland Cerebral Palsy Project, Belfast, UK	1981 ongoing	25–28,000	5 years	(R)
25	North of England Collaborative Cerebral Palsy Survey, Gateshead, United Kingdom	1960 ongoing	34,000	3–5 years	(R) Registration to a wider area since 1991 birth year cohort.
26	Survey, Groot Klimmendaal Rehabilitation centre, Arnhen, Netherlands	1977–1988	15,000	6–20 years	(S) No more cases being registered.
27	Cerebral Palsy in the County of Vestfold, Norway, Tonsberg, Norway	1970 ongoing	2,500	4 years	(R) Expanding case registration to a wider area.
28	Centro Per le Disabilita Neuromotorie Infantili, Bologna, Italy	1965 ongoing	9,000	Population-based survey	(R)
29	National Cerebral Palsy Register, Ljubljana, Slovenia	1988 ongoing	28,000	2–3 years	(R)

them make accurate predictions about comorbid conditions (eg, cognitive impairment and epilepsy), to support research into such interventions as intensive physiotherapy and botulinum toxin,⁴⁴ and to predict survival rates. A register can be used to identify a group of children with a particular problem, such as visual impairment, for whom a

particular intervention or care plan could then be audited.

USE OF CP REGISTERS IN RESEARCH

CP registers can be used to investigate the origins of CP using, for instance, a case-control study design, because it provides an unbiased sample of

cases from a geographically defined population. Controls need to be selected from the same population, or else routinely collected data for the whole birth population, if available, may be used for comparison purposes. Comparing the frequency of demographic, clinical, and other factors in cases and controls identifies risk factors. The contribution of a risk factor to the total amount of CP in the population can be estimated as attributable risk. Case-control studies have contributed to the recognition that infection and other maternal antenatal factors are important risk factors in both term and preterm CP.^{41,45-47} Such studies have also suggested that although intrapartum hypoxia is an important risk factor, it accounts for no more than 10% of all CP cases.⁴⁸

CP registers are also useful for monitoring trends over time in the numbers, rates, and characteristics of children with CP within the population. The function and quality of life for children with CP can be assessed, and the costs of care evaluated. CP registers can contribute to the evaluation of interventions aimed at:

- Reducing the frequency of CP. When a risk factor is identified, randomized controlled trials can be mounted to test the impact on the numbers of children with CP of an intervention that reduces the frequency of the risk factor in the population. An ongoing register may provide outcome data for such a trial in, for example, the use of maternal antibiotics in premature onset of labor.^{49,50}
- Improving the function and quality of life for children with CP. A register may provide a sampling frame for recruitment to randomized

trials of interventions, allowing, if necessary, selection of children with similar characteristics.

- Measuring the cost-effectiveness of interventions. This can be done within the context of a randomized controlled trial of an intervention.

CONCLUSION

The failure of child health information systems to monitor trends and rates of childhood disability has been highlighted in the United Kingdom.⁵¹ Registers are different from routine information systems, because their data are more accurate and the completeness of ascertainment is better. There is a need for methodological rigor when compiling a register.

Some registers of childhood impairments focus not only on CP, but also on other impairments, including intellectual and sensorial disorders. This might be useful for planning purposes and might increase the efficiency of the register. For a particular impairment, such as CP, collaborative efforts through networks of registers are essential.

Registers must be used to monitor trends in rates and characteristics of children with CP, for planning services and as a basis for research into both etiology and interventions. CP registers also inform public health officials and policy makers about regional numbers of children with CP, allowing funding for medical, educational, and social services for children with CP to be matched to current and projected needs.

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