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What influences physiotherapy use by children with cerebral palsy?

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Abstract

Aim To investigate factors that influence the frequency of physiotherapy currently used by a population of children with moderate to severe cerebral palsy (CP).

Methods A survey using a postal questionnaire was sent to 212 parents of children with moderate to severe CP. The families were identified from a geographically defined case register of children with CP in Northern Ireland (the Northern Ireland Cerebral Palsy Register). Eighty-five per cent of parents responded. One-third of parent responses regarding their child's use of physiotherapy were validated with their child's physiotherapist and the level of agreement was high.

Results Ninety-four per cent (169/180) of children received conventional physiotherapy from a statutory source during the school term. Of these, 61% (104/169) used 'intense' levels of physiotherapy (defined as at least twice a week). A higher proportion of intense users were children with severe CP compared with moderate CP (69% vs. 47%; $P < 0.01$); with moderate intellectual impairment ($IQ \leq 70$) compared with severe ($IQ \leq 50$) or no intellectual impairment ($IQ > 70$) (81% vs. 64% vs. 39% respectively; $P < 0.01$) and at schools for physical disability (PD) compared with severe learning disability (SLD) or mainstream (MS) schools (82% vs. 66% vs. none respectively; $P < 0.001$). After controlling for severity of motor impairment and the presence and severity of intellectual impairment, children with CP at MS schools used on average significantly less physiotherapy compared with children with similar levels of motor impairment at PD schools ($P < 0.001$).

Conclusions Children with CP in MS schools use less physiotherapy compared with children with similar levels of disability in special schools. Organizing services around special schools may limit the degree to which children with CP and other disabilities are successfully integrated into MS education.

Keywords

cerebral palsy, physiotherapy, health services research, service organization, schooling

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Introduction

Physiotherapy is a key service in the management of children with developmental disabilities like cerebral palsy (CP). Physiotherapy involves the application of a set of therapeutic techniques

incorporating active treatment such as motor skill training; and passive handling such as movements to stretch specific muscle groups (Bower & McLellan 1992). Overall, paediatric physiotherapy aims to improve motor function in the child with CP although other areas of importance include the

prevention of complications and deterioration in the child's condition. A range of broader objectives such as maximizing the child's physical, emotional and social potential, inspiring confidence in the child and family and enhancing their quality of life have also been noted (Bax & MacKeith 1967; Warren & Cohen 1986; Tirosch & Rabino 1989; Levitt 1995).

Cerebral palsy is not a single disease entity but rather a collection of conditions primarily affecting motor function and caused by an insult to the developing brain (Bax 1964). The aims of physiotherapy for children with CP vary by age and the severity of the child's condition (Levitt 1995). For example, physiotherapy in the first 2 years of life aims to develop the precursors of independent mobility (postural control, balance and righting reactions) and promote normal motor development before abnormal patterns become established (Levitt 1995). The emphasis in school-aged children is to provide continued assessment, consultation with parents and professionals and to promote optimal function enhancing all the benefits of the school environment (Harryman 1992). Treatment aims can also vary depending on whether the physiotherapist is acting at the level of impairment (e.g. spasticity) or function (e.g. walking ability). In relation to functional abilities, independent walking is one possible motor outcome for the child with CP. Most children with 'milder' forms of CP will achieve some degree of functional, independent walking (Bleck 1975; Crothers & Paine 1988; Campos da Paz *et al.* 1994) and this evidence is further supported by the development of standardized measures like the Gross Motor Function Classification Scheme which can be used to give a prognosis for gross motor function in children with CP (Palisano *et al.* 2000; Rosenbaum *et al.* 2002). In more severely affected children, in particular those with significant intellectual impairment, the aims of physiotherapy are more conservative.

One of the major issues in relation to paediatric physiotherapy services for children with CP is the lack of conclusive, empirical evidence to support the effectiveness of physiotherapy as provided by trained professionals in improving motor outcomes or preventing complications (Butler &

Darrah 2001). The paediatric physiotherapy service is an expensive, scarce resource and in the absence of generalizable evidence there are no guidelines to help physiotherapists prioritize and standardize the care they deliver to children with CP.

Some studies have sought to identify child characteristics associated with the greatest potential to benefit from physiotherapy in terms of improved motor outcomes. Among randomized controlled trials (as reviewed by Butler & Darrah 2001), one study found an association between younger age and positive treatment outcomes (Law *et al.* 1991); one found an association between milder forms of CP and positive treatment outcomes (Palmer *et al.* 1988); and one found intellectual ability to be unrelated to whether there was a positive treatment outcome (Law *et al.* 1991). Among other studies of lower levels of evidence, three found no association between age and positive treatment outcome (Scherzer *et al.* 1976; Sommerfeld *et al.* 1981; Trahan & Malouin 1999); one study found no association between severity of CP and positive treatment outcome (Scherzer *et al.* 1976); one found an association between higher intellectual ability and positive treatment outcome (Scherzer *et al.* 1976). Since this review, Bower *et al.* (2001), in a randomized controlled trial of 56 children undergoing a period of intensive vs. usual amounts of physiotherapy; and goal-directed vs. aim-directed physiotherapy, found no significant differences in functional and performance outcome scores. Despite the uncertainty of 'what works' in paediatric physiotherapy, there is a consensus that physiotherapy should remain a basic right for all children with physical disabilities (McConachie *et al.* 1997; Bax 2001) and more specifically for children with CP (Jenkins & Sells 1984; Levitt 1995). Several population-based studies (Gough *et al.* 1993; Haylock *et al.* 1993; Parkes *et al.* 2002) investigating services for children with CP have found that the majority of children receive statutory forms of physiotherapy and often 'intense' levels of treatment.

This paper is the second in a series about use of physiotherapy services by children with CP. Unlike the previous paper, here we confine the results to those children in receipt of conventional or statutory forms of physiotherapy and identify the fac-

tors that influence the frequency of physiotherapy used by a geographically defined population of children with moderate to severe CP.

Method

Participants

Parents of children with moderate to severe CP, aged 4–14 years, were identified from the Northern Ireland Cerebral Palsy Register (NICPR). The methods of the NICPR are described elsewhere (Parkes *et al.* 2001) as are the detailed methods of the survey described here (Parkes *et al.* 2002).

The study was conducted during 1994–98 and had the approval of the Ethics Committee, The Queen's University of Belfast. A total of 212 families with a child with moderate to severe CP were sent a postal questionnaire of which 85% (185/212) responded. Severity of CP was defined in terms of function using leg function with or without the use of aids as a crude indicator. Moderate CP was an 'obviously abnormal gait restricting mobility and lifestyle, with or without the use of aids' and severe CP as 'no independent walking' (taken from Evans *et al.* 1989). An external check of parents' reports regarding use of physiotherapy services was made using a random sample of physiotherapists' records. With permission, one-third of the study participants had their service data followed up and validated by their child's physiotherapist. There was over 90% agreement between parent and professional reports on all aspects of the physiotherapy service relating to the frequency and venue of treatment.

Information available on child characteristics taken from the NICPR included age, sex, deprivation quintile (based on area of residence), type of CP (using the classification scheme of the Surveillance of Cerebral Palsy in Europe project; see SCPE 2000), severity of motor impairment using leg function as an indicator and the presence and severity of associated impairments (intellectual, visual, hearing and the presence of active seizures). [Information about deprivation was derived from electoral ward using the Townsend Deprivation Index (Townsend *et al.* 1988) which produced a score for each electoral ward based upon over-

crowding, housing tenure and employment. The Register population was then sorted by their Townsend score and divided into quintiles ranging from one – the least deprived quintile to five – the most deprived quintile of child population.] Intellectual impairment was defined as normal/mild if the IQ > 70; moderate if IQ ≤ 70 > 50 and severe/profound if IQ ≤ 50. Vision was defined as normal/mild impairment if visual acuity (VA) was >6/18 in the better eye; moderately impaired if VA was 6/18–6/60 in the better eye; and severe/profoundly impaired if VA was <6/60 in the better eye or there was no useful vision. Hearing was defined as normal/mildly impaired if loss was within the range of 21–45 dB loss without aids; moderately impaired if loss was within the range of 45–70 dB without aids and severe/profoundly impaired if loss was >70 dB. Seizures were defined as present if they existed in the 12 months preceding completion of the assessment form.

Information from the postal questionnaire included: age at which the child was diagnosed as having CP, the parents' employment status, if they had given up work or changed job since having a child with CP, education, lone parenthood, family size, having another child with special needs, parental demand for physiotherapy and the importance parents' attached to continuing therapy at home. Parents were asked to specify how often their child received physiotherapy (daily; at least twice a week; weekly; fortnightly; monthly or less; none) as provided by a trained physiotherapist during a specified school term.

Statistical analysis

The data were analysed using SPSS/PC (version 9). The majority of variables were nominal or ordinal level and therefore non-parametric techniques were used for data analysis. The Mann–Whitney *U*-test was used to analyse differences in physiotherapy use between two comparison groups within the independent variable(s). The Kruskal–Wallis test was used to analyse differences in physiotherapy use between three or more comparison groups within the independent variable(s). These tests are suitable when the dependent variable is ordinal.

The frequency of physiotherapy use was coded from 0 meaning 'no physiotherapy used', 1 'less than monthly', 2 'monthly', 3 'fortnightly', 4 'weekly', 5 'at least twice a week' and 6 'daily'. This was used as the basis for calculating the average values of physiotherapy use within each of the categories or subgroups: a higher score means higher use. The Mann–Whitney *U* and Kruskal–Wallis test work by generating 'mean rank scores' which are the result of comparing the number of times the values of physiotherapy use (ranging from 0 to 6) in one group of the independent variable (e.g. males) ranks higher than the values of physiotherapy use in the other group (e.g. females). When used the results quoted here were corrected to take account of tied ranks. Chi-square was also used to compare proportions in frequency of physiotherapy use defined as 'intense' (at least twice a week) and 'non-intense' (less than twice a week and including no therapy) between comparison groups of the independent variable.

The variables which appeared to influence use of physiotherapy were further tested while controlling for other variables. However, all statistical testing is non-parametric and only bivariate tests were used. The mean rank scores for each possible combination are shown in two-way tables.

Results

During the school term 96% (173/180) of children with moderate to severe CP received therapy. Of these, 169/173 used conventional physiotherapy

from a statutory source. The 169 children receiving statutory physiotherapy services are the focus of the following analysis. Of these, 61% were 'intense users' of the service (i.e. treated at least twice a week). Three-quarters (76%; 129/169) of children received sessions lasting between 15 and 30 min and the median length of a session was 30 min. Children who received physiotherapy more often tended to receive sessions of shorter duration. Seven children did not use any physiotherapy during the school term.

School attended by severity of motor impairment and the presence and severity of intellectual impairment are shown in Table 1. Just over half (56%; 26/46) the children with an IQ > 70 were at mainstream (MS) schools and a higher proportion of these children could walk with or without the use of aids [22/26 vs. 13/20 at physical disability (PD) schools]. None of the children with intellectual impairment (i.e. IQ ≤ 70) were in MS schools regardless of the severity of their motor impairment.

Table 2 shows use of physiotherapy services as mean rank scores and the proportion receiving intense physiotherapy by child characteristics. The child characteristics found to be significantly related to physiotherapy use were severity of motor impairment, intellectual impairment and type of school attended. It is noteworthy that those children who received orthopaedic surgery in the last 6 months did not differ significantly in the amount of physiotherapy used compared with those who had no surgical intervention in the same time interval.

Table 1. Severity of motor impairment, intellectual impairment by type of school attended (*n* = 169)

Intellectual impairment	Motor impairment	Type of school attended			Total
		MS schools	PD schools	SLD schools	
None (IQ > 70)	Walk without aids	8	7	–	15
	Walk with aids	14	6	–	20
	No walking	4	7	–	22
	Total	26	20	–	46
Moderate (IQ ≤ 70 > 50)	Walk without aids	–	2	2	4
	Walk with aids	–	2	2	4
	No walking	–	17	7	24
	Total	–	21	11	32
Severe (IQ ≤ 50)	Walk without aids	–	–	6	6
	Walk with aids	–	–	10	10
	No walking	–	4	71	75
	Total	–	4	87	91

MS, mainstream; PD, physical disability; SLD, severe learning disability.

Table 2. Frequency of physiotherapy use by child characteristics ($n = 169$)

Child characteristics	Categories	Number using statutory physiotherapy services (total = 169)	Mean rank of physiotherapy service use*	Test results (all corrected for ties)	% (of 169) using intense physiotherapy	χ^2 results (intense vs. non-intense /none)
Age	4–6 years	57	90.31	Kruskal–Wallis test $\chi^2 = 1.62$, d.f. = 3, $P = 0.65$	65	$\chi^2 = 1.19$ d.f. = 3 $P > 0.05$
	7–9 year	38	88.10		58	
	10–12 year	51	85.43		61	
	13–15 year	23	76.59		52	
Sex	Male	98	87.33	Mann–Whitney U -test $Z = -0.28$, $P = 0.77$	62	$\chi^2 = 0.90$ d.f. = 2 $P > 0.05$
	Female	71	85.38		59	
Severity (leg function)	Moderate	59	70.77	Mann–Whitney U -test $Z = -3.10$, $P = 0.001$	47	$\chi^2 = 6.70$ d.f. = 1 $P = 0.006$
	Severe	110	92.63		69	
Type of CP	Spastic hemiplegia	12	75.42	Kruskal–Wallis test $\chi^2 = 5.29$, d.f. = , $P = 0.25$	50	$\chi^2 = 3.12$ d.f. = 3 $P > 0.5$
	BSCP leg dominated	20	70.07		45	
	BSCP all other	110	89.93		63	
	Ataxia	7	105.38		64	
	Athetosis	20	86.20			
Intellectual impairment	None/mild	46	62.42	Kruskal–Wallis test $\chi^2 = 17.8$, d.f. = 2, $P = 0.001$	39	$\chi^2 = 14.9$ d.f. = 2 $P = 0.001$
	Moderate	32	99.89		81	
	Severe	91	91.18		64	
Type of school	Mainstream	26	28.62	Kruskal–Wallis test $\chi^2 = 52.09$, d.f. = 2, $P = 0.0001$	–	$\chi^2 = 50.0$ d.f. = 2 $P < 0.001$
	Physical disability	49	100.14		82	
	SLD	94	92.70		66	
Seizures (last 12 months)	None	119	84.16	Mann–Whitney U -test $Z = -1.07$, $P = 0.28$	59	$\chi^2 = 0.36$ d.f. = 1 $P > 0.05$
	Active seizures	50	92.21		64	
Communication	Some communication	106	81.53	Mann–Whitney U -test $Z = -1.52$, $P = 0.12$	57	$\chi^2 = 0.93$ d.f. = 1 $P > 0.05$
	No method of communication	63	92.25		67	
Usual vision	Normal/near normal	114	81.96	Kruskal–Wallis test $\chi^2 = 2.35$, d.f. = 2, $P = 0.30$	60	$\chi^2 = 0.42$ d.f. = 2 $P > 0.05$
	Moderate	21	89.95		62	
	Severe/profound	34	94.34		66	
Age at diagnosis	0–6 months	51	94.26	Kruskal–Wallis test $\chi^2 = 5.67$, d.f. = 4, $P = 0.22$	69	$\chi^2 = 3.96$ d.f. = 3 $P > 0.05$
	7–12 months	65	87.73		61	
	13–24 months	35	83.43		56	
	25–36 months	16	65.94		44	
	37–61 months	2	63.75		–	
Orthopaedic surgery (last 6 months)	Surgery last 6 months	14	39.50	Mann–Whitney U -test $Z = -1.47$, $P = 0.13$	61	$\chi^2 = 0.03$ d.f. = 1 $P > 0.05$
	None/past only	82	50.04		59	

CP, cerebral palsy; BSCP, bilateral spastic cerebral palsy; d.f., degrees of freedom; SLD, severe learning disability.

*Where the possible range of scores for physiotherapy was '0' = none to '6' = daily.

Table 3 shows use of physiotherapy services as mean rank scores and proportion receiving intense physiotherapy by family characteristics. None of these variables were found to be statistically significant in relation to physiotherapy use.

Differences in use of physiotherapy services by intellectual impairment remained after control-

ling for severity of motor impairment (see Table 4) although some caution is needed in the interpretation of the results because of small numbers. There appeared to be significant differences in the level of physiotherapy use between children in all three categories of intellectual impairment who were able to walk. Although

Table 3. Frequency of physiotherapy use by family characteristics

Family characteristics	Categories	Number of cases (total = 169)	Mean rank of physiotherapy service use*	Test results (all corrected for ties)	% (of 169) using intense physiotherapy (i.e. at least twice per week)	χ^2 results (intense vs. non-intense/none use of physiotherapy)
Deprivation quintile	Least deprived (1) (2) (3) (4) (5)	39 36 30 34 30	92.65 78.50 80.45 80.99 99.94	Kruskal-Wallis test $\chi^2 = 5.77$, d.f. = 4, $P = 0.21$	70 51 53 51 71	$\chi^2 = 5.96$, d.f. = 4 $P > 0.05$
Overall employment status	Most deprived No-one in paid work Part-time work only Full-time work	64 66 39	85.63 83.47 88.65	Kruskal-Wallis test $\chi^2 = 0.34$, d.f. = 2, $P = 0.84$	60 50 60	$\chi^2 = 0.23$, d.f. = 2 $P > 0.05$
Overall education status	No-one with formal qualifications School-based qualifications only Higher qualifications	60 61 48	89.22 84.31 85.95	Kruskal-Wallis test $\chi^2 = 0.37$, d.f. = 2, $P = 0.82$	62 56 62	$\chi^2 = 0.69$, d.f. = 2 $P > 0.05$
Lone parenthood	No Yes	143 26	86.35 87.33	Mann-Whitney U -test $Z = -0.10$, $P = 0.91$	61 58	$\chi^2 = 0.09$, d.f. = 1 $P > 0.05$
Family size (total)	1-4 family members 5-8 family members 9-12 family members	71 91 7	85.55 86.99 89.79	Kruskal-Wallis test $\chi^2 = 0.08$, d.f. = 2, $P = 0.96$	58 62 57	$\chi^2 = 0.31$ d.f. = 2 $P > 0.05$
Another child with special needs	No Yes	151 18	87.85 77.25	Mann-Whitney U -test $Z = -0.92$, $P = 0.35$	61 56	$\chi^2 = 0.20$, d.f. = 1 $P > 0.05$
Job change after child with CP	No Yes	99 70	87.66 84.85	Mann-Whitney U -test $Z = -0.40$, $P = 0.68$	62 59	$\chi^2 = 0.14$, d.f. = 1 $P > 0.05$
Parent demand for more physiotherapy	No Yes Not sure	30 121 13	71.36 88.36 82.79	Kruskal-Wallis test $\chi^2 = 2.69$, d.f. = 2, $P = 0.25$	71 59 83	$\chi^2 = 3.61$, d.f. = 2 $P > 0.05$
Importance parents attached to doing home therapy	Very important Important Quite important Not very important	94 51 7 3	84.03 77.88 69.79 83.67	Kruskal-Wallis test $\chi^2 = 1.89$, d.f. = 4, $P = 0.75$	66 63 43 67	$\chi^2 = 1.50$, d.f. = 3 $P > 0.05$

CP, cerebral palsy.

*Where the possible range of scores for physiotherapy was '0' = none to '6' = daily.

Table 4. Use of physiotherapy by presence of intellectual impairment controlling for severity of motor disability

Intellectual impairment	Severity of motor disability	
	Moderate* (walkers)	Severe† (non-walkers)
None/mild (IQ > 70)	25.36 (n = 35)	45.27 (n = 11)
Moderate (IQ ≤ 70 > 50)	40.50 (n = 8)	59.67 (n = 24)
Severe (IQ ≤ 50)	34.91 (n = 16)	55.67 (n = 75)

*Kruskal–Wallis *H*-test, corrected for ties $\chi^2 = 7.90$, d.f. = 2, $P = 0.01$.

†Kruskal–Wallis *H*-test, corrected for ties $\chi^2 = 2.06$, d.f. = 2, $P = 0.35$.

Table 5. Use of physiotherapy by presence of intellectual impairment controlling for type of school attended

Intellectual impairment	Type of school attended	
	Physical disability*	Learning disability†
None/mild (IQ > 70)	26.95 (n = 20)	–
Moderate (IQ ≤ 70 > 50)	23.44 (n = 25)	60.50 (n = 7)
Severe (IQ ≤ 50)	23.75 (n = 4)	46.45 (n = 87)

*Kruskal–Wallis *H*-test, corrected for ties $\chi^2 = 1.38$, d.f. = 2, $P = 0.50$.

†Mann–Whitney *U*-test, corrected for ties $Z = -1.49$, $P = 0.13$.

not statistically significant a similar pattern was reported for children who were unable to walk. Overall, non-walkers compared with walking children within each category of intellectual impairment used more physiotherapy.

Table 5 shows physiotherapy use by intellectual impairment controlling for type of school attended. This analysis was restricted to children in special schools as none of the children in MS schools had intellectual impairment (i.e. IQ > 70). Children in each category of intellectual impairment who attended PD schools had similar mean rank scores, while children at schools for severe learning disability (SLD) with a moderate intellectual impairment appeared to receive a higher, but not statistically significant level of physiotherapy than children with severe intellectual impairment.

Table 6 shows physiotherapy use by type of school controlling for severity of motor impair-

Table 6. Physiotherapy use by type of school attended controlling for severity of motor disability

Type of school	Severity of motor disability	
	Moderate* (walkers)	Severe† (non-walkers)
Mainstream	14.48 (n = 22)	18.13 (n = 4)
Physical disability	42.21 (n = 19)	57.97 (n = 30)
Severe learning disability	36.08 (n = 18)	56.49 (n = 76)

*Kruskal–Wallis *H*-test: corrected for ties: $\chi^2 = 34.39$, d.f. = 2, $P = 0.0001$.

†Kruskal–Wallis *H*-test: corrected for ties: $\chi^2 = 7.68$, d.f. = 2, $P = 0.02$.

ment and suggests that there are significant differences in the amount of physiotherapy used by type of school attended by both walking and non-walking groups. Walking children at PD schools were on average higher users than walking children at MS or SLD schools. Non-walking children in special schools had similar mean rank scores which were three times higher than non-walking children who attended MS schools. It is important to note the small numbers of children in each subgroup.

Finally, Table 7 shows physiotherapy use by type of school attended by intellectual impairment and suggests there were significant differences in the amount of physiotherapy used by type of school attended within each subgroup of intellectual impairment. Type of school attended appeared to impact on service use for children in the none/mild category of intellectual impairment, some of whom attended MS schools. Among this group the mean rank score for children in PD schools was more than twice the score recorded for children who attended MS schools.

A further analysis was carried out to explore where the significant differences in physiotherapy use lie between severity of motor impairment by intellectual impairment by school placement. This analysis confirmed that there were no significant differences in physiotherapy use *within* schools after controlling for severity of motor impairment and the presence of intellectual impairment; but there were significant differences *between* schools where children with comparable levels of motor

Type of school	Presence of intellectual impairment		
	None/mild* IQ > 70	Moderate† IQ ≤ 70 > 50	Severe‡ IQ ≤ 50
Mainstream	14.71 (n = 26)	–	–
Physical disability	34.92 (n = 20)	15.66 (n = 25)	49.63 (n = 4)
Severe learning disability	–	19.50 (n = 7)	45.83 (n = 87)

*Mann–Whitney *U*-test: corrected for ties: $Z = -5.31$, $P = 0.0001$.

†Mann–Whitney *U*-test: corrected for ties: $Z = -1.40$, $P = 0.15$.

‡Mann–Whitney *U*-test: corrected for ties: $Z = -0.31$, $P = 0.75$.

Table 7. Physiotherapy use by type of school attended controlling for intellectual impairment

impairment and intellect used different amounts of physiotherapy.

Discussion

The findings from this study suggest that receipt of statutory physiotherapy services for children with CP is influenced by the way in which the service is organized – in this instance around special education. Children with CP at MS schools were consistently lower users of the service: none of the children at MS schools were intensive users of the service compared with 18/20 children with comparable levels of motor impairment and intellect at PD schools. It is noteworthy that physiotherapy use did not differ significantly by other child and family variables as might have been expected. For example, physiotherapy use did not differ by age of the child (although children from the younger age groups were higher users of the service compared with older children, $P > 0.05$); by receipt of orthopaedic surgery in the previous 6 months; by parental demand or by the importance parents attached to carrying out therapy routines at home.

Use of the service did vary by severity of the child's motor impairment and the presence and severity of intellectual impairment with more severely affected children using physiotherapy more often. A number of other studies have reported that physiotherapy use increases with severity of the child's condition (Gough *et al.* 1993; Haylock *et al.* 1993). The levels of treatment reported here are higher than those reported by Gough *et al.* (1993) and Haylock *et al.* (1993), suggesting that regional variations in service delivery

may exist. The frequency of physiotherapy use varied more by intellectual impairment than by level of motor impairment. This may be explained by the fact that all children with an intellectual impairment attended special educational schools.

While there is a policy in the UK towards inclusion of children with 'special needs' into MS schools (Special Educational Needs and Disability Act 2001) and with the development of community Child Development Centres and multidisciplinary Child Development Teams offering community-based health care (McConachie *et al.* 1999), the extent to which this policy has been successfully achieved is likely to be variable both within and between regions and countries in the UK and elsewhere. Interestingly the extent and pattern of inclusion in MS schools reported here is similar to that reported by Beckung & Hagberg (2002) in one region of Sweden. More research is needed to explore the relationships and impact of service arrangements, schooling and other environmental factors on the child's ability to participate in society and their quality of life. A major study, running from April 2003 for 3 years and funded by Research Framework 5 of the European Commission (QLG5-CT-2002-000636), is investigating this in eight centres with registers of children with CP.

If need for physiotherapy services is defined according to severity of disability where severely disabled children compared with moderately disabled children receive more treatment, then the physiotherapy service was targeted appropriately to those in 'greatest need'. One of the problems in defining need for the service in this way includes uncertainty about whether physiotherapy is the best

way to help severely disabled children achieve quality of life and maximize their potential (Giangreco 1986). In contrast, children with moderate CP had a relatively low level of service receipt yet these children may show the greatest capacity for change in their physical condition over time and there is evidence from a randomized controlled trial (level 1 evidence) of an association between milder CP and improvements in motor function following physiotherapy (Palmer *et al.* 1988). If need for the physiotherapy service is defined in terms of those with the greatest capacity to benefit from the service then it is possible that physiotherapy services are inappropriately and inefficiently targeted at groups of children least likely to achieve significant clinical change in their gross motor function.

One possible limitation of this study is the use of a crude measure of functional severity in CP (leg function). Alternatives to this method now include the Gross Motor Function Classification Scheme (or GMFCS; Palisano *et al.* 1997; Palisano *et al.* 2000) although this was not available at the time of data collection. The incorporation of the GMFCS would provide a valid and reliable description of function in children with CP up to the age of 12 years and enable linkage of the data to information on gross motor prognosis by Rosenbaum *et al.* (2002) and the implications for dimensions on participation in society (Beckung & Hagberg 2002). Future studies using the registers of children with CP could incorporate the GMFCS prospectively for newly diagnosed children undergoing clinical examination and registration. However the particular strengths of the analysis presented here includes an in-depth consideration of the interrelationships between child and family characteristics and service variables, the inclusion of a wide age range of children and the advantages of using a case register approach in identifying an unselected series of children with CP living in a geographically defined area.

The findings of this study indicate that provision and delivery of community-based paediatric physiotherapy services for children with CP in one region of the UK are organized around 'system' variables (special education in this instance) as opposed to child- or family-led need. This was particularly evident when children in MS schools

received less physiotherapy compared with children with similar levels of disability in special schools. It could be argued that organizing services around special schools is an efficient way to deliver services to children with the most severe forms of CP and other disabilities. However, this may further limit the degree to which children with CP and other disabilities are successfully integrated into MS schools and warrants further investigation.

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