Durable Equipment Use of Persons with Spastic Quadriplegic Cerebral Palsy at a Specialized School and Hospital in the United States

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Abstract
In order to illustrate the equipment needs of persons with spastic quadriplegic cerebral palsy, and to provide a useful reference point for residential habilitative centers, durable equipment use was inventoried for 57 children and young adults (mean age 21.3 years) with spastic quadriplegic cerebral palsy residing at a specialized school/hospital. The most frequently prescribed/provided equipment items were manual wheelchairs, wheelchair laptrays, travel headrests, shower/commode chairs, recreational electronics, bumper pads, and corrective lenses.

Introduction
Researchers have explored the medical, social and educational needs of persons with severe chronic handicaps (Hagberg, Edebol-Tysk & Edström, 1988; Thomas et al., 1985). Additionally, Edebol-Tysk (1989) and Barabas, Matthews and Zumoff (1992) have documented the considerable human resources that are required to meet those needs.

While several researchers have examined equipment use in samples highly heterogenous with regard to diagnosis (Fischer, Toczek and Seeger, 1993; Korpela, Seppänen and Koivikko, 1992) or have focused on one specific type of equipment (Kohn, Enders, Preston & Motloch, 1983) researchers have not catalogued the range of equipment used by a specialized facility in providing care to persons with spastic quadriplegic cerebral palsy. The present study examines the broad range of equipment used by persons with spastic quadriplegic cerebral palsy at the Matheny School & Hospital, an inpatient and outpatient facility serving children and young adults with severe, chronic neurologic disorders.

It is to be noted that the data provided should not be interpreted as representing a “best practice” model for the provision of assistive equipment since outcome data are not presented. Nor do we assume that the equipment use at this facility is representative of that at other similar facilities in the United States. We do, however, believe that the information presented in this paper will serve as a useful reference point, particularly given the paucity of data in this area.

Method
Subjects
The sample consisted of 57 individuals (33 males, 24 females) receiving residential services at the Matheny School & Hospital with a diagnosis of spastic quadriplegic cerebral palsy. The age range was 9.3 years to 37.5 years with a mean of 21.3 years (sd = 6.37).

Of the 57 patients, 14 (24.6 %) had a history of seizures, seven (12.3 %) had a significant hearing loss, and five (8.7 %) had severe visual impairment. Eight patients (14 %) had gastrostomies. Of the 49 patients who did not have gastrostomies, 34 (69.4 %) required significant feeding assistance, and 15 (30.6 %) were independent feeders. The patients studied represented a wide range of intellectual functioning, although most (84 %) evidenced mental retardation somewhere in the mild to profound range. The largest portion (30 %) were within the moderate mental retardation range.

Procedure
A multidisciplinary panel of occupational, physical, speech-language, music and recreation therapists collaborated in the construction of a list of equipment items used at the facility in the ongoing care of persons with spastic quadriplegia. Included in the inventory were all orthotic devices, positioning equipment, wheelchairs and other mobility equipment, communication equipment, visual and auditory corrective equipment (i.e. glasses, hearing aids), and personal recreation equipment (e.g., radios, computers, etc.) Once constructed, this list was used by personal care staff to develop the inventory of equipment used by each patient.
Results

Inventory data

Inventory data are presented in Table 1. Equipment pieces are clustered roughly based on functional category. While the data indicate that many patients make use of orthotic/positioning equipment (particularly bumper pads) as well as showering and bathing equipment, the greatest use of equipment is in the area of mobility. Over 200 mobility-related devices (e.g. power-assisted wheelchairs, manual wheelchairs, laptrays, travel headrests, walkers, etc.) are used by the 57 patients represented in this study.

The relative infrequency with which many of the items co-occurred in their use by persons in this sample makes it difficult to empirically define a "prototypical case." An examination of the more frequently prescribed items, however, suggests that the typical patient with spastic quadriplegia at Matheny most likely has a manual wheelchair and laptray, a travel headrest, a shower/commode chair, a bumper pad, and a tape player or some other recreational music device. Consistent with the high incidence of ocular abnormalities in persons with cerebral palsy (Black, 1980; Mitchell, 1983), the inventory also suggested that the typical patient with spastic quadriplegia would likely wear corrective lenses.

Although not in the majority, a sizable number of patients additionally had power-assisted wheelchairs, ankle-foot orthoses, and manual communication equipment. A somewhat smaller percentage made use of augmentative electronic communication devices.

Power wheelchair utilization

Among users of power-assisted wheelchairs, males represented a slightly higher proportion than did females (45.5% and 33.3% respectively). Analyses did not, however, demonstrate a significant association between gender and likelihood of power wheelchair use. \( \chi^2 (1, N = 57) = 0.85, p = \text{ns.} \)

There was, however, a significant age difference between those who utilized power wheelchairs and those who did not, \( t(55) = -3.47, p < .005. \) The mean age of persons using power wheelchairs was 24.6 years, while those who did not use power wheelchairs had a mean age of 19.1 years. Due to the relative infrequency with which young children are prescribed power-assisted wheelchairs, the analysis was repeated without the inclusion of children under the age of 12. Even with this restriction, the age difference between the two groups was significant, \( t(53) = 3.17, p < .005. \)

Power wheelchair use was not related to whether or not an individual had seizures, nor to hearing impairment. Interestingly, two of the five persons who were legally blind had sufficient visual capability to allow the use of power-assisted wheelchairs.

The reasons why power-assisted wheelchairs were not prescribed for a given individual were considered. Therapy staff classified individuals who did not have power wheelchairs as (a) not needing them due to ability to walk or self-propel, (b) not able to benefit from the technology due to cognitive, behavioral, or physical limitations, or (c) currently in training for eventual power-wheelchair use. They found that of the 34 persons who did not have power-wheelchairs, four (11.8%) did not need them because of ability to walk or self-propel, 29 (85.3%) did not have them because of difficulties that would limit their benefit, and one (2.9%) was under training for future power-wheelchair use.

Electronic communication device utilization

There were no significant differences in age between those patients using electronic augmentative communication devices and those who did not, \( t(55) = 0.80, p = \text{ns.} \) Twenty-five percent of the females and 15% of the males in the study used electronic augmentative communication devices. Analyses failed, however, to demonstrate a significant association between gender and use of such devices, Fisher's Exact Test, \( p = \text{ns.} \)

Augmentative communication device use was not related to whether or not the individual had seizures, or whether the patient had hearing impairment.

The reasons why electronic communication devices had not been prescribed were considered. Therapy staff deemed individuals who did not have electronic communication devices as (a) not needing one due to sufficient verbal capacity, (b) not able to benefit from the technology due to cognitive, behavioral, or physical limitations, or (c) currently in training for eventual use of an electronic communication device, or (d) declined use. They found that of the 46 persons who did not have electronic communication devices, 18 (39.1%) did not need them, 24 (52.2%) did not have them because of difficulties that would limit their benefit, one was (2.2%) under training for future use, and three (6.5%) refused their use. The group of persons who did not have electronic communication devices because they did not need them had a mean age significantly higher than that of those deemed unable to benefit, \( t(40) = 2.20, p < .05. \) The mean ages were 23.5 and 19.25 respectively. Since recent years have seen a marked increase in the proportion of young persons admitted to the facility who have profound physical and mental limitations, this age difference is most likely reflective of a changing patient population.

Co-occurrence of power wheelchair and electronic communication device use

Of the 57 patients in this sample, nine (15.7%) had both power assisted wheelchairs and electronic augmentative communication devices. A contingency table is presented (see Table 2) to further describe the co-occurrence of power wheelchairs and electronic communication devices.

Interestingly, all of those patients who staff determined to be unable to benefit appreciably from electronic communication devices (23 patients) were also deemed to be unable to benefit from power-wheelchair technology. Conversely, 23 of the 27 deemed unable to benefit from power-wheelchair technology were considered unable to benefit from electronic communication devices. Although several patients were considered to be cognitively capable of negotiating the intricacies of electronic communication devices, they lacked sufficient behavioral judgment to use power wheelchairs successfully.

Equipment cost estimates

Based on the results of the inventory, estimates of total equipment costs for individuals such as those served by this specialized facility were made. Since power-assisted wheelchairs and electronic communication devices often constitute the greatest monetary expense among durable equipment, it is helpful to consider separately the costs of providing equipment to those who use such devices and those who do not. Approximate cost ranges are presented in Table 3.

The 32 patients who did not utilize power wheelchairs or electronic communication devices represented 56% of the total sample. These individuals, with a manual wheelchair and a typical array of orthopedic, recreational, and mobility equipment might be expected to possess equipment ranging in cost from...
roughly $5,000 to $10,000 (U.S.). Beyond these initial costs are the considerable costs associated with maintenance, repair, and replacement.

Given the typical cost of a power assisted wheelchair (ranging from $5,000 to $18,000 depending upon manufacturer, seating customization, and other variables) and that of an electronic augmentative communication system (ranging from $4,000 to $8,500), one can easily expect that funds to support the needs of patients who utilize both devices constitute a highly disproportionate piece of a facility’s equipment expenditures.

When combined with the various orthopedic, recreational, and mobility equipment, one might anticipate a typical patient with a power wheelchair and electronic communication device to be using equipment with total costs roughly ranging from $14,000 to $36,000 at any point. Once again it must be recognized that these estimates do not represent ongoing expenses such as maintenance and repair costs, replacement costs, or expenses associated with the training of staff and patients in the proper use of such equipment.

**Discussion**

The inventory data presented here are illustrative of the considerable equipment needs of persons with spastic quadriplegic cerebral palsy, particularly with regard to the use of power-assisted wheelchairs and electronic communication equipment. From these data, it is quite clear that the cost of the provision of durable equipment to those receiving services from a facility like that represented here is substantial.

It is not surprising that the greatest number of devices prescribed and offered at this facility were in the area of mobility. Not only did all individuals in this sample have mobility limitations that necessitated the use of wheelchairs, but those persons who benefited from power-assisted wheelchairs also had manual wheelchairs for use in traveling or as “backup” should the power-assisted wheelchair become unavailable.

Although the physical challenges faced by the persons in the sample studied here are relatively severe, staff at this facility are aggressive in their prescription of “high-tech” assistive devices such as power-assisted wheelchairs and electronic communication devices. Despite this liberal use of technology, there remains a large number of persons who have physical and or cognitive difficulties that make effective use of high-tech devices unlikely. The specific nature of those difficulties and the obstacles that they present are not entirely clear. For example, is the use of electronic communication devices hampered in individuals who have difficulties with simultaneous processing such that they cannot simultaneously compose or define a message and attend to the mechanics of operating the device?

What is the proportion of persons who cannot use power-assisted wheelchairs because available switch options are not suitable, and what capabilities might they have for which new switch options can be developed? Studies that address questions such as these would be of great value.

**References**


**Author Notes**

The authors wish to acknowledge the assistance of the staff of the Matheny School & Hospital in the collection of data for this study.
### Table 1. Equipment Inventory

#### Orthotic/Positioning Devices
- one or more armstraps/legstraps: 6 (10.5%)
- one or more armsplints/legsplints: 12 (21.1%)
- left and right ankle-foot orthoses: 19 (33.3%)
- knee immobilizer: 2 (3.5%)
- body jacket: 5 (8.8%)
- bed jacket: 1 (1.8%)
- bed insert: 2 (3.5%)
- bumper pad: 36 (63.2%)
- stander: 2 (3.5%)
- sidelyer: 1 (1.8%)

#### Mobility-related Devices
- power wheelchair: 23 (40.4%)
- manual wheelchair: 57 (100%)
- laptray: 52 (91.2%)
- travel headrest: 48 (84.2%)
- walker: 5 (8.8%)
- travel stroller: 2 (3.5%)
- helmet: 3 (5.3%)

#### Bathing/Toileting Devices
- shower/commode chair: 45 (78.9%)
- bath trolley: 12 (21.1%)

#### Communication Devices
- manual comm. equip.: 20 (35.1%)
- electronic comm. equip.: 11 (19.3%)
- headpointer: 3 (5.3%)

#### Corrective Devices for Sensory Impairment
- hearing aid: 4 (7.0%)
- glasses: 36 (63.2%)

#### Recreational/Occupational Electronic Devices
- tape player, cd, radio: 44 (77.2%)
- keyboard: 4 (7.0%)
- computer (patient's own): 3 (5.3%)
- pageturner: 3 (5.3%)

Other pieces of equipment not in use by patients in this sample but that should be considered are crutches, bilateral crutches, and quadricanes.
Table 2.
Co-occurrence of Power-Assisted Wheelchairs and Electronic Communication Devices

<table>
<thead>
<tr>
<th>Electronic Communication Device?</th>
<th>No</th>
<th>Yes</th>
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<tbody>
<tr>
<td>Power-Assisted Wheelchair?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>32</td>
<td>2</td>
</tr>
<tr>
<td>Yes</td>
<td>14</td>
<td>9</td>
</tr>
</tbody>
</table>

Table 3.
Approximate Total Equipment Costs (U.S. Dollars)

<table>
<thead>
<tr>
<th>Equipment needs</th>
<th>Approximate cost range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons without “HiTech” equipment needs</td>
<td>$5,000 - $10,000</td>
</tr>
<tr>
<td>Persons using a power-assisted wheelchair</td>
<td>$10,000 - $28,000</td>
</tr>
<tr>
<td>Persons using an electronic communication</td>
<td>$9,000 - $19,000</td>
</tr>
<tr>
<td>Persons using both a power-assisted</td>
<td>$14,000 - 36,000</td>
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<tr>
<td>wheelchair and an electronic</td>
<td></td>
</tr>
<tr>
<td>communication device</td>
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</tr>
</tbody>
</table>

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