During the past 15 years, increased attention has been paid to the late effects of poliomyelitis, which may begin as long as 10 to 50 years after the initial infection. The main symptoms are new or increased weakness in affected muscles; fatigue; and pain from muscles, joints, or both (Gawne & Halstead, 1995; Grimby & Thorén-Jönsson, 1994).

Researchers consider it important to prevent overload of joints and already-weak muscles in persons with late effects of polio (Gawne & Halstead, 1995) and have reported that the experience of pain is related not to the degree of muscle weakness, but to the level of physical activities (Willén & Grimby, 1998). Interventions to prevent overload might be to prescribe mobility and other technical aids and to adapt homes and workplaces. However, the knowledge regarding the need for and the effects of these possible interventions is scarce. When this study was planned, abilities in activities of daily living (ADL) had only been briefly mentioned in previous publications regarding late effects of polio, the exceptions being two Swedish studies in which this question was more thoroughly addressed (Einarsson & Grimby, 1990; Grimby & Thorén-Jönsson, 1994). When the use of technical aids was mentioned, usually only data regarding mobility aids was presented (Einarsson & Grimby, 1990; Grimby & Thorén-Jönsson, 1994; Lønnberg, 1993). Data regarding the use of technical aids other than mobility aids and the need for adaptation of homes and workplaces were, at the time of this study, lacking in the literature. However, a Swedish study has been published recently that describes data regarding functional performance in ADL, housing adaptation, and use of assistive devices (Thorén-Jönsson & Grimby, 2001).

The primary aim of the study reported here was to describe functional performance in activities of daily living (ADL) and the use of technical aids among persons with late effects of polio.

### OBJECTIVE

The purpose of this study was to describe functional performance in activities of daily living (ADL) and the use of technical aids among persons with late effects of polio.

### METHOD

Abilities in ADL of 150 participants 20 to 82 years of age were assessed with the Sunnaas Index of ADL, and the participants’ use of technical aids was recorded.

### RESULTS

The activities in which most participants were independent were eating, daily hygiene, and communication. Many needed technical aids, adaptation of their homes, or both to perform mobility-related activities and to dress or undress, take a bath or shower, cook, or manage toilet visits. In total, 86 (57%) used mobility aids such as canes, crutches, and walkers. Thirty-one (21%) used wheelchairs within or outside the home. Bath and shower aids were the most commonly used technical aids other than mobility aids. The activity where most participants depended on others was housework.

### CONCLUSION

In spite of their disabilities, most participants performed well in many ADL, functioning independently by using technical aids and by living in an adapted environment.

the functional performance and use of technical aids differed among the participants in relationship to a demographic or disease-specific variable.

Method

Participants

Over an 18-month period, adults 18 years of age or older with late effects of polio who visited the post-polio outpatient clinic at a university hospital in Sweden were consecutively asked to participate in the study. To be considered, they had to have a confirmed history of poliomyelitis, functional stability after recovery from the poliomyelitis for a minimum of 5 years, and the subsequent occurrence of additional symptoms. Furthermore, the potential participants had to be able to read and understand Swedish and have no cognitive impairment. During the study period, 168 adults were considered. Of these, 13 could not be included because of language difficulties, and 5 declined participation for unknown reasons.

The 150 participants (86 women, 64 men) ranged in age from 20 to 82 years (median = 61 years). They had had their acute poliomyelitis 20 to 80 years (median = 47 years) before the study. Duration of functional stability after recovery ranged from 7 to 75 years (median = 38 years). The late effects of the polio had occurred from 1 to 48 years (median = 8 years) before data collection. All participants had homes of their own, with 59 (39%) living alone.

Procedure

Each participant underwent a comprehensive medical, physical, and occupational examination. The occupational therapy evaluation was performed by the first author and included a comprehensive, individual interview regarding the participant’s daily occupations, his or her environment at home and work, and the use of technical aids. Furthermore, the occupational therapist observed each participant’s indoor mobility, transfers to and from a chair or wheelchair, and the use of technical mobility aids during the clinic visit. The interview and the observations formed the basis for scoring the Sunnaas Index of ADL.

The Sunnaas Index of ADL

The Sunnaas Index of ADL measures performance of 12 activities. It was developed by occupational therapists at the Sunnaas Rehabilitation Hospital in Norway (Vardeberg, Kolsrud, & Laberg, 1991) and enables the occupational therapist to assess a patient’s independence or dependence. Each activity on the index can be given a score between 0 and 3 points, for a maximum possible score of 36 points. The higher the score, the more independent the person. Eleven of the 12 activities are divided hierarchically into three subscales (see Figure 1) according to how often help may be needed. Communication is the only activity not included in the subscales (Vardeberg et al., 1991). The interrater reliability of the index has been found to be 97% (Olsson & Tervald, 1992). When applied, Cronbach’s alpha showed .95. The correlations between each single activity and the total sum score have been found to vary between .73 and .90, except for the Communication subscale (r = .56) (Olsson & Tervald, 1992). Concurrent validity of the index (Korpelainen, Niilekselä, & Myllylä, 1997) and, recently, the interitem consistency between items in the index and corresponding items in the Functional Independent Measure (Claesson & Svensson, 2001) have been described.

The Sunnaas Index of ADL has been used to assess more than 500 patients after cerebrovascular accident, spinal cord injury, poliomyelitis sequelae, and traumatic brain injury (Vardeberg, 1993). The index has been translated from Norwegian to Swedish and used for Swedish patients with, for example, cerebrovascular accident, rheumatoid arthritis, or total hip replacement (Claesson & Svensson, 2001; Olsson & Tervald, 1992) and in randomized, controlled studies regarding the effects of

![Figure 1. The Sunnaas Index of ADL. Eleven of the 12 activities are divided hierarchically into three subscales (I–III) that are based on how often help may be needed if the person is scored as dependent (0 or 1).](http://ajot.aota.org)
acupuncture in the treatment of stroke patients (Gosman-Hedström et al., 1998; Kjendahl, Sällström, Østen, Stanghelle, & Borchgrevink, 1997).

Statistical Analysis

Statistical significance was accepted if \( p \leq .05 \). Differences between male and female participants were investigated with the Mann Whitney \( U \) test. Relationships between age and index scores and between number of years with late effects of polio and index scores were analyzed with Spearman rank order correlations.

Ethical Considerations

All potential participants were given both written and oral information about the study by the first author. Informed consent was given by the individuals willing to participate. The local ethical committee at the hospital approved the study.

Results

Sunnaas Index of ADL

The median total index score for the 150 participants was 31 (range 10–36). The participants were often independent regarding the activities in Subscale I but more often depended on others to be able to perform the activities in Subscale III (see Figure 2).

The activities in which the participants were most independent were eating, daily hygiene, and communication (see Figure 2). Because of the use of technical aids, having an adapted environment, or both, the participants were independent regarding mobility-related activities, dressing and undressing, bathing and showering, cooking, and toilet management. The activity in which the participants needed most help from others was housework other than cooking.

Gender, Age, and Years With Disease

No significant differences in index scores were found between men and women. Moderate negative correlations were found between age and the scores for Subscale I \( (r = -.46, p < .001) \), Subscale II \( (r = -.36, p < .001) \), Subscale III \( (r = -.46, p < .001) \), and total index \( (r = -.47, p < .001) \). Low negative correlations were found between the number of years since the occurrence of the late effects of polio and the scores for Subscale II \( (r = -.19, p < .05) \), Subscale III \( (r = -.19, p < .05) \), and total index \( (r = -.20, p < .05) \).

Technical Aids, Mobility, and Housing

In total, 86 (57%) participants used mobility aids such as canes, crutches, walkers, and wheelchairs. Thirty-one (21%) used wheelchairs within their homes, outside their homes, or both.

Bath and shower aids were the most commonly used technical aids other than mobility aids (see Table 1). Seventy-four (49%) participants used a total of 197 different technical aids (1–7 per person, not including mobility aids) at home. No significant difference was found between men and women in the number of technical aids used nor could any significant correlation be found between the number of years since the occurrence of the late effects of polio and the use of technical aids.

Seven (5%) participants were unable to walk. The remaining 143 could walk short distances indoors with or without mobility aids. Seventy-two (50%) of the 143 participants could walk on uneven surfaces.

![Figure 2. The Sunnaas Index of ADL. Participants’ ADL ability in each of 12 activities is presented as the percentage of participants on the basis of obtained ADL scores. The higher the score, the more independent the participant (n = 150). For example, 95% of all participants obtained a score of 3 points on eating, and 5% obtained a score of 2 points on eating.](image-url)
Discussion

The findings of this study showed that in spite of their disabilities, the participants largely managed their functional performance in ADL independently. Most commonly, participants could manage eating, hygiene, and communication on their own. To a considerable extent, the participants’ independent functional performance was due to their use of technical aids, an adapted home or workplace environment, or both.

The extent of the use of mobility aids among participants was found to be within the range of previously reported findings (35%–66%) (Einarsson & Grimby, 1990; Grimby & Thorén-Jönsson, 1994; Thorén-Jönsson & Grimby, 2001). Half of our participants also used other technical aids to maintain independence in ADL. Thorén-Jönsson and Grimby (2001) also reported an extended use of technical aids other than mobility aids among their participants. Although both studies have shown that many different aids were used, it has been conjectured that persons with post-polio may often be less well-supplied with technical aids (Nätterlund & Ahlström, 1999). Indeed, Thorén-Jönsson and Grimby (2001) identified a further need of mobility aids in their investigated group.

Whether the number and kind of technical aids that were used by the participants in our study corresponded to their needs is a question that was not addressed. However, we found that the participants with a longer history of late effects of polio and reduced ability of functional performance did not have an increased number of technical aids. This finding may imply a neglected prescription of aids by the occupational therapists or that the patient has not been able to accept his or her increased need for mobility or other technical aids (Thorén-Jönsson & Grimby, 2001). The findings that no differences could be found between men and women regarding functional performance in ADL and use of technical aids were somewhat unexpected because pain, much related to physical activity, has been shown to be more pronounced in women than in men (Kling, Persson, & Gardulf, 2000; Lennberg, 1993; Thorén-Jönsson & Grimby, 2001; Widar & Ahlström, 1998; Willén & Grimby, 1998).

We also found that only one fourth of the study participants had received help to adapt their environment at home. This finding contrasts that of Thorén-Jönsson and Grimby (2001), who found that almost 60% of their participants had received or needed this help. This inconsistency may indicate that the participants in our study had met less often with occupational therapists knowledgeable about late effects of polio. An important task for the occupational therapist meeting patients with this condition is to investigate the need for and suggest home and workplace modifications (Jones, 1991).

Conclusion

The Sunnaas Index of ADL was easy to use in the clinical setting. It turned out to be useful to investigate the extent to which participants could be independent in performing the common ADL by using mobility-related or other technical aids and an adapted environment. Other ADL instruments may not distinguish between independence with or without aids or adaptations at home. Information about the use of technical aids and home adaptations is important to the occupational therapist because the overuse of muscles is probably an important factor in the development of the late effects of polio (Gawne & Halstead, 1995). For the occupational therapist, it is important to record the use and need of mobility and technical aids, paying attention to the degree of polio involvement (Thorén-Jönsson & Grimby, 2001), age, and years with the deteriorating condition. However, a need exists for further studies by occupational therapists regarding the kind, number, and appropriate use of technical aids that are optimal for preventing further deterioration of the condition.

Table 1. Use of Technical Aids by Persons With Late Effects of Polio

<table>
<thead>
<tr>
<th>Technical Aid</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bath and shower</td>
<td>67</td>
<td>45</td>
</tr>
<tr>
<td>Bath board</td>
<td>23</td>
<td>34</td>
</tr>
<tr>
<td>Shower stool</td>
<td>21</td>
<td>31</td>
</tr>
<tr>
<td>Shower chair</td>
<td>12</td>
<td>18</td>
</tr>
<tr>
<td>Bath seat</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Power bath lift</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Toilet</td>
<td>27</td>
<td>18</td>
</tr>
<tr>
<td>Raised toilet seat</td>
<td>21</td>
<td>78</td>
</tr>
<tr>
<td>Toilet surround rails</td>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>Combined toilet and bidet</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Bed</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Height-adjustable and variable-posture bed</td>
<td>8</td>
<td>57</td>
</tr>
<tr>
<td>Mattress incliner</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>Lifting pole</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>Kitchen</td>
<td>35</td>
<td>23</td>
</tr>
<tr>
<td>Perching stool</td>
<td>26</td>
<td>74</td>
</tr>
<tr>
<td>Food-preparation equipment</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>Mobility trolley</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Grab rails and bars</td>
<td>26</td>
<td>17</td>
</tr>
<tr>
<td>Reacher</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>Sock puller</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Sliding board</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>5</td>
</tr>
</tbody>
</table>

Note. n = 150. A participant may use more than one technical aid.

*Other than mobility aids.
Acknowledgments

We thank Neil Tomkinson of Preston, England, for his help with the language revision. This study was supported by grants from the Swedish Foundation for Health-care Sciences and Allergy Research, the Karolinska Institutet, and the Huddinge University Hospital.

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