Computer Therapy Compared With Usual Care for People With Long-Standing Aphasia Poststroke: A Pilot Randomized Controlled Trial
Rebecca Palmer, Pam Enderby, Cindy Cooper, Nick Latimer, Steven Julious, Gail Paterson, Munyaradzi Dimairo, Simon Dixon, Jane Mortley, Rose Hilton, Audrey Delaney and Helen Hughes

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Background and Purpose—The purpose of this study was to test the feasibility of conducting a randomized controlled trial to study the effectiveness of self-managed computer treatment for people with long-standing aphasia after stroke.

Method—In this pilot single-blinded, parallel-group, randomized controlled trial participants with aphasia were allocated to self-managed computer treatment with volunteer support or usual care (everyday language activity). The 5-month intervention period was followed by 3 months without intervention to investigate treatment maintenance.

Results—Thirty-four participants were recruited. Seventeen participants were allocated to each group. Thirteen participants from the usual care group and 15 from the computer treatment group were followed up at 5 months. An average of 4 hours 43 minutes speech and language therapy time and 4 hours volunteer support time enabled an average of 25 hours of independent practice. The difference in percentage change in naming ability from baseline at 5 months between groups was 19.8% (95% CI, 4.4–35.2; \(P=0.014\)) in favor of the treatment group. Participants with more severe aphasia showed little benefit. Results demonstrate early indications of cost-effectiveness of self-managed computer therapy.

Conclusion—This pilot trial indicates that self-managed computer therapy for aphasia is feasible and that it will be practical to recruit sufficient participants to conduct an appropriately powered clinical trial to investigate the effectiveness of self-managed computer therapy for people with long-standing aphasia.


Key Words: aphasia ● computerized therapy ● cost-effectiveness ● self-management
management of continued aphasia treatment. There is growing evidence to suggest that the use of aphasia software can help to improve outcomes in language domains including reading, spelling, and expressive language. However, to date, studies of self-administered word-finding therapy have been limited to descriptive case series with the only reported randomized controlled study for computer use with patients with aphasia focused on reading therapy.

Although computer-based services for aphasia treatment in the long term may be assumed to be efficient and a low-cost option, the actual cost-effectiveness of this method of service delivery has not been investigated. The relative cost-effectiveness of different methods of service delivery is important to establish to demonstrate cost-effective use of health service resources to commissioners determining service provision.

This study investigated the feasibility of conducting a rigorous randomized controlled trial into the effectiveness of self-managed computer treatment for people with long-standing aphasia poststroke.

Materials and Methods

Design
A single-blinded, parallel-group, stratified randomized controlled trial was piloted, in which participants with aphasia were randomized to computer treatment or usual care. A 5-month intervention period was followed by a period without intervention to indicate whether any effect of the treatment was maintained.

Sample Size
There had not been any large randomized studies in computer treatment for word finding in aphasia on which to base the sample size. Julious recommends at least 12 (evaluable) participants per group at follow-up for pilot studies. The study aimed to recruit 30 participants in recognition that not all participants would complete the study.

Participants
Eligible participants were identified from local support groups and speech and language therapy department records in South Yorkshire and Newcastle & North Tyneside, UK. Participants were included in the study if they had a diagnosis of stroke and aphasia with word-finding difficulties as 1 of the predominant features as assessed by the Comprehensive Aphasia Test and the Object and Action Naming Battery. In addition, participants were included only if they had the ability to repeat spoken words presented by the recruiting speech and language therapist. Eligible participants no longer received impairment-focused speech and language therapy enabling the computer treatment to be better isolated and evaluated. People with severe visual or cognitive difficulties reducing ability to use the computer program were excluded from the study, tested by the ability to see and perform a simple, nonlanguage-based computer game. Participants with motor deficits poststroke were not excluded from the study. Where upper limb impairments made physical manipulation of the computer hardware difficult, assistive devices such as tracker balls or touch screen computers were offered to enable access to the computer treatment.

Recruitment
Participants who no longer received active speech and language therapy were identified by speech and language therapists and volunteers in Stroke groups. A research speech and language therapist (SLT) carried out a short language screen to enable provision of information about the study in a format best suited to the individual’s communication needs. Where the participant was unable to understand aphasia-friendly formats of the study information, assent was sought from a relative. Baseline information was collected for each participant including aphasia classification and aphasia severity (based on performance on subtests of the Comprehensive Aphasia Test and baseline word-finding ability (based on the Object and Action Naming Battery).

Randomization and Blinding
Consenting participants were randomized to the intervention or control group using a web-based randomization system. Stratified randomization was used based on severity of aphasia (mild/moderate/severe) and time poststroke (<2 years/2 years). It was not possible to blind the participant to the intervention provided. However, baseline assessments were conducted before randomization, and assessment of outcomes was undertaken blind to baseline performance and treatment allocation by SLTs not involved in recruitment and intervention.

Control Group
Participants randomized to the control group continued usual care, that is, participation in activities that provide general language stimulation as they had done previously: attendance at communication support groups and conversation, reading, and writing activities that are part of everyday life.

Intervention Group
Participants randomized to the intervention group continued to participate in their usual language activities (as described previously). In addition, they received speech and language therapy intervention delivered through independent use of a computer therapy program (StepbyStep) configured by a SLT and supported by a volunteer.

StepbyStep Computer Program
The StepbyStep computer program contains a library of >13 000 language exercises. Photographic images can be added to enable practice of personally relevant words such as names of people and pets. Each exercise follows steps progressing from listening to target words, producing words with visual, semantic, phonemic, or written letter/word cues through to saying the words in sentences.

SLT Role
Software was loaded onto the participant’s own computer or loaned study laptop computer. The SLT tailored the steps in the therapy process as appropriate to the abilities and needs of the individual participant and provided initial tuition to the participant and caregiver on how to use the computer exercises and progress through the therapy steps.

Independent Practice
The participants were advised to work through the computer exercises for at least 20 minutes 3 days a week for 5 months (approximately 1500 minutes of practice time in total).

Volunteer Role
Volunteers included SLT students and existing volunteers from communication support groups. They were given a 3-hour training session on how to use the StepbyStep program and their role in supporting the intervention. This included assistance in using the software and hardware, encouragement to practice, and activities to promote use of the new words in daily life. Volunteers contacted the participants once a week in the first month and at least once a month thereafter by telephone or home visit.

Outcomes Measures
The primary outcomes of the pilot study relate to the feasibility of carrying out the study design and using self-managed computer treatment supported by volunteers as a long-term intervention. The primary measures of feasibility were the recruitment rate, completion rates, and statistical variability so that the number of participants needed in a definitive study can be estimated. Outcomes indicating
feasibility of the intervention included the percentage of the eligible population interested in receiving the intervention, the ability to offer the intervention per protocol (provision of computer software and volunteer support), and the ability of the participants to carry out the intervention per protocol (using the computer for at least 20 minutes 3 times a week for 5 months). Amount of practice time was stored by the StepbyStep computer software automatically and reviewed by an SLT at the end of treatment. The secondary outcomes included measures of clinical and cost-effectiveness to be fully evaluated in an appropriately powered randomized controlled trial. Clinical effectiveness of the self-managed computer intervention for word finding was indicated by the change in word retrieval ability measured by naming words that had been practiced in treatment at 5 and 8 months from baseline. The intervention and control groups named 48 words from the Object and Action Naming Battery.23 The intervention group practiced these words during the treatment and the control group received no treatment. In addition, participants in the intervention group practiced 48 words of personal relevance.

Cost-effectiveness data were collected and analyzed in the pilot to investigate the feasibility of carrying out a cost-effectiveness analysis with this population and to indicate the value of carrying out a larger trial.

Cost-effectiveness was investigated by estimating total costs (including intervention costs and other healthcare resource use costs collected using patient and caregiver diaries) and total quality-adjusted life-years (QALYs) calculated using a pictorial version of the EQ5D24 questionnaire (adapted for this study to be accessible to patients with aphasia) for an incremental cost-effectiveness ratio to be calculated. An incremental cost-effectiveness ratio represents the additional costs associated with the intervention and the additional benefits associated with the intervention (measured in QALYs) as a ratio. It represents the incremental cost per additional QALY gained associated with the computer treatment compared with usual care.

Ethical Approval, Study Organization, and Data Management

The study received approval from Yorkshire and the Humber National Health Service ethics committee. Administrative activities, data management, and statistical analyses were conducted within the Clinical Trials Research Unit at the University of Sheffield. Four people with aphasia and their caregivers, identified by therapists, formed a study advisory group to ensure procedures and materials were suitable for use with participants with aphasia.

Statistical Analysis

Primary analysis of secondary outcome of clinical effectiveness of computerized treatment for word retrieval was analyzed based on an intention-to-treat approach by estimating the mean difference in percentage improvement of words named correctly between the treatment and control groups at 5 months adjusted for baseline naming ability using analysis of covariance model. Marginal means and treatment effect with its associated 95% CI and probability values were presented and reported. Exploratory analysis in participants who complied with the protocol was also undertaken using the same model under per-protocol (PP) principle. Further analysis was also conducted at 8 months to explore any potential maintenance of treatment effect.

Sample size for a future definitive trial was undertaken using a residual variance estimated from the analysis of covariance model at 5 months’ measures (excluding patients with naming ability of <10% at baseline). We also applied inflation factors to the sample size taking into account the uncertainty in the estimation of the pilot SD27 and expected dropout rate.

Cost-Effectiveness Analysis

Trial data were included within a simple decision analytic model, which was used to estimate the cost-effectiveness of the intervention over the lifetime of the patients. Key parameters included the quality-of-life gain associated with a good response to the interven-

Results

Feasibility of Conducting a Study

Recruitment Rates

The original target of recruiting 30 participants in 12 months was met. Because the number of withdrawals was higher than expected in the first few months of recruitment, 4 extra participants were recruited to ensure outcome data were available for at least 12 participants in each arm resulting in a recruitment total of 34 participants. The recruitment rate was 1.4 patients per site per month over a 12-month period where a site included past patient lists from speech therapy departments and voluntary sector organizations in a region. In South Yorkshire, recruitment was continued for 15 months due to early indications of a higher dropout rate than expected. Only 1 participant was recruited in the final 3 months suggesting that saturation in an area is reached after 12 months when recruiting from this prevalent population.

Completion Rates

All 17 participants allocated to the control group completed baseline measures, 13 (76.5%) completed 5-month outcome measures, and 11 (64.7%) completed 8-month outcome measures (Figure 1). Three participants withdrew due to ill health and 3 due to not wishing to complete the protocol. Informal discussion suggested that completing the resource use diaries for the health economic evaluation placed a burden on some participants. Of the 17 participants allocated to the intervention group, 16 completed baseline measures (1 participant became ineligible after a further stroke between randomization and completion of baseline measures). Fifteen participants completed 5-month outcomes in the treatment group (88.2%). Thirteen of the 17 (76.5%) completed the 8-month outcomes. Reasons for withdrawal from the treatment group included ill health and change in family circumstances. Nobody withdrew due to not wishing to carry out the trial protocol.

Study Participant Characteristics

Table 1 shows that the majority of participants were recruited from South Yorkshire because this was the primary site, with a second site, Newcastle & North Tyneside, becoming involved in the second 6 months of the recruitment phase. There was an even distribution of ages between the groups and a greater number of men than women took part in the study. Participants ranged from 1 to 29 years poststroke. The majority were >2 years poststroke with the mean average being 6.6 and 6.2 years poststroke in the control and intervention groups, respectively. The majority of participants had mild aphasia and there were greater numbers of participants with nonfluent aphasia than fluent or global aphasia,28 evenly matched across groups. Three of the participants also had a diagnosis of verbal dyspraxia in
each group in addition to the aphasia. Online-only Data Supplement Table I shows the characteristics of participants were relatively equally distributed between intervention and control groups on language domains tested by the Comprehensive Aphasia Test. Of particular note is that auditory comprehension ability was similar in each group. The majority of participants had mild comprehension impairments (11 in the control group, 12 in the intervention group), 3 participants in each group had no comprehension deficit, 2 in each group had moderate comprehension impairment, and none of the participants had severe comprehension deficits. Because the average percentage of words named correctly was based on a standard word set only for the control group and the standard words plus personally selected words for the intervention group, the mean percentage of all words named was lower in the intervention group than the control group because participants chose words that they found particularly difficult to say.

Feasibility of the Intervention

Interest
Of the eligible target population, 89.3% were interested in receiving self-managed word-finding treatment with a computer and consented to participate in the study (Figure 1).

Ability to Offer the Intervention PP
Of the 17 participants randomized to receive the intervention, 13 (76.5%) were offered computer intervention and a trained volunteer to support them with its use. Volunteer support was unavailable for the remaining 4 participants.

Ability of Participants to Carry Out the Self-Managed Intervention PP
Ten (66.7%) of the 15 participants completing 5-month outcome measures carried out the intervention PP (using the computer independently for 20 minutes at least 3 times a week across the 5 months with access to volunteer support). Of the 4 without volunteer support, 3 did not practice with the recommended frequency. One participant with volunteer support did not practice with the recommended frequency. Online-only Data Supplement Figure II shows the broad distribution of amounts of practice time and corresponding changes in naming ability.

Ability to Use the Computer Independently
An average of 4 hours 43 minutes from a SLT and 4 hours volunteer support time enabled 25 hours of independent practice (1500 minutes). A mean 75% of the intervention time was independent practice of the computer exercises indicating the ability of participants to use the computer independently.

Secondary End Points: Clinical and Economic Outcomes

Clinical Effectiveness
The intervention was associated with 19.8% (95% CI, 4.4%–35.2%; \( P = 0.014 \)) mean improvement in change in percentage of all words named correctly at 5 months. The
effect was higher in favor of the intervention group by 23.2% (95% CI, 7.9%–41.3%; P/H11005 0.006) in PP participants. The wide CI of this estimate reflects the small sample size.

Table 2 shows exploratory results of efficacy at 5 and 8 months of follow-up for the intention-to-treat and PP sets.

Although the mean difference in change was not statistically significant (at 5%) at 8 months, the percentage change was still greater in the intervention group. The mean profile on Figure 2 indicates that the smaller difference between the groups at 8 months from baseline was due to a small decrease in improvement between 5 and 8 months for the intervention group and an increase in the naming performance of the control group between 5 and 8 months.

Figure 3 shows that although there is considerable variation in the performance of the control group between baseline and 5 months, the intervention group shows a more consistent trend for improvement between baseline and 5 months. It is clear that this trend is not applicable to participants who were able to name <10% of words at baseline. Excluding these participants in both groups from the analysis (intention-to-treat), the intervention was associated with 23.1% (95% CI, 7.2%–39.0%; P/H11005 0.007) mean improvement in change in percentage of words named correctly at 5 months.

Table 1. Participant Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Group</th>
<th>Intervention Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>n=17</td>
<td>n=16</td>
</tr>
<tr>
<td>Center</td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Yorkshire</td>
<td>11 (64.7%)</td>
<td>13 (81.3%)</td>
</tr>
<tr>
<td>Newcastle &amp; North Tyneside</td>
<td>6 (35.3%)</td>
<td>3 (18.8%)</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
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<tr>
<td>Mean (SD)</td>
<td>66.2 (12.3)</td>
<td>69.5 (12.2)</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>66.5 (53.8–76.5)</td>
<td>70.3 (64.7–79.3)</td>
</tr>
<tr>
<td>Minimum to maximum</td>
<td>48.2–83.7</td>
<td>37.8–82.6</td>
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<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12 (70.6%)</td>
<td>9 (56.3%)</td>
</tr>
<tr>
<td>Female</td>
<td>5 (29.4%)</td>
<td>7 (43.8%)</td>
</tr>
<tr>
<td>Time postonset, y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum to maximum</td>
<td>1.8–12</td>
<td>1–29</td>
</tr>
<tr>
<td>Mean</td>
<td>6.6</td>
<td>6.2</td>
</tr>
<tr>
<td>&lt;2 y</td>
<td>1 (5.9%)</td>
<td>3 (18.8%)</td>
</tr>
<tr>
<td>≥2 y</td>
<td>16 (94.1%)</td>
<td>13 (81.3%)</td>
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<tr>
<td>Aphasia classification</td>
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<tr>
<td>Fluent</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Non fluent</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>Global</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Dyspraxia in addition to</td>
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<td></td>
</tr>
<tr>
<td>aphasia</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Severity of aphasia</td>
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<td></td>
</tr>
<tr>
<td>Mild</td>
<td>11 (64.7%)</td>
<td>9 (56.3%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>4 (23.5%)</td>
<td>5 (31.3%)</td>
</tr>
<tr>
<td>Severe</td>
<td>2 (11.8%)</td>
<td>2 (12.5%)</td>
</tr>
<tr>
<td>Percentage of all treated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>words named correctly at</td>
<td>n=17</td>
<td>n=15*</td>
</tr>
<tr>
<td>baseline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>51.7 (33.8)</td>
<td>38.5 (26.5)</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>58.3 (16.7–77.1)</td>
<td>44.8 (7.3–58.3)</td>
</tr>
<tr>
<td>Minimum to maximum</td>
<td>0.0–97.9</td>
<td>0.0–78.1</td>
</tr>
</tbody>
</table>

IQR indicates interquartile range.

*One participant had missing word set at baseline. Data in this table refer to all randomized participants irrespective of what happens after randomization.

Table 2. Mean Difference in the Percentage Change in Words Named Correctly Between the Control and Treatment Groups at 5 and 8 Mo From Baseline

<table>
<thead>
<tr>
<th>Analysis Set</th>
<th>Follow-Up, Mo</th>
<th>No. of Participants Within the Group</th>
<th>Control Group, No. (mm)</th>
<th>Intervention Group, No. (mm)</th>
<th>MDC (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITT</td>
<td>5</td>
<td>28</td>
<td>13 (47.4)</td>
<td>15 (67.2)</td>
<td>19.8 (4.4–35.2)</td>
<td>0.014*</td>
</tr>
<tr>
<td>PP</td>
<td>5</td>
<td>23</td>
<td>13 (52.7)</td>
<td>10 (77.3)</td>
<td>24.6 (7.9–41.3)</td>
<td>0.006*</td>
</tr>
<tr>
<td>ITT</td>
<td>8</td>
<td>23</td>
<td>11 (56.6)</td>
<td>12 (67.9)</td>
<td>11.3 (–7.4 to 29.9)</td>
<td>0.221</td>
</tr>
<tr>
<td>PP</td>
<td>8</td>
<td>20</td>
<td>11 (60.8)</td>
<td>9 (77.7)</td>
<td>16.9 (–2.1 to 35.9)</td>
<td>0.077</td>
</tr>
</tbody>
</table>

mm indicates marginal mean of change from baseline; MDC, mean difference in change from baseline; ITT, intention to treat; PP, per protocol.

*Statistically significant at the 5% significance level.
which translated to a completion rate of 28 of 33 (85%; 95% CI, 68%–95%).

With an observed SD of 17.38%, minimal clinically meaningful difference of 10% in naming ability, and a predicted dropout rate of up to 20%, we will need a total of 160 patients at 90% power and 5% 2-sided significance level. We inflated the sample size by a factor of 1.14 taking into account the uncertainty in the estimation of the pilot SD due to the fact that this is relatively a small study.27,29,30 Therefore, a definitive study will require a total of 184 patients (92 per group).

**Cost-Effectiveness**

The intervention is estimated to lead to marginally increased costs over a participant’s lifetime compared with usual care (control £18 687 [$29 956] and intervention £19 124 [$30 657]). However, the 0.14 QALY gain (control 3.07 and intervention 3.22) means that the incremental cost-effectiveness ratio is £3058.21 ($4900) suggesting that the intervention is cost-effective based on an incremental cost-effectiveness ratio threshold of £20 000 ($32 050) per additional QALY gained. In the United Kingdom, typically an intervention is classed as cost-effective if it provides 1 additional QALY for an incremental cost-effectiveness ratio of £20 000 ($32 050) or less, which is equivalent to an incremental cost-effectiveness ratio of £20 000 ($32 050).31

**Discussion**

This study demonstrates that use of a self-managed treatment for word-finding practice with minimal input from a SLT, and volunteer support is a feasible means of enabling continued intervention for people with aphasia after stroke. People with aphasia were able to use the computer software to practice naming words independently, which supports findings from previous case series reports in the literature.14–16 A modest amount of input from a SLT to tailor exercises to the individual’s needs, and support from a volunteer, enabled independent practice to continue over a 5-month period. This is in contrast to other self-managed computer treatments in which practice has not continued over time. These self-managed interventions rely solely on independent practice without support. For example, de Graaf et al32 report difficulties with adherence to unsupported computerized cognitive–behavioral therapy. Volunteer support may therefore be an important component of a computerized intervention to promote continued practice.

Clinical benefit was indicated because the intervention group improved their naming ability significantly more than the control group after 5 months of treatment on average with a trend toward maintenance of the treatment effect 3 months after the end of treatment. However, the wide CIs reflect the small size of the sample in this pilot study and the range of true effect. This demonstrates the need for a fully powered randomized controlled trial to provide robust evidence of treatment effect. Some face-to-face treatments have resulted in improvements in severe aphasia shown in a meta-analysis of aphasia treatment studies by Robey.7 However, participants naming <10% of words at baseline showed no improvement in this study. This indicates little clinical benefit of self-managed intervention with more severely affected individuals and therefore it would not be appropriate to include participants with severe word-finding difficulties in a larger study.

Based on the data from this study and an economic model that extrapolates beyond the trial period, we were able to collect sufficient data to estimate that the intervention represents a cost-effective use of National Health Service resources. However, this is subject to uncertainties including the quality-of-life gain, the relapse rate, and the changes over time in patients who are not treated. A larger trial is required to reduce these uncertainties.

Results from this pilot study have been used to calculate a requirement of 184 participants for a fully powered random-
ized controlled trial allowing for dropout. Because 250,000 people have aphasia in the United Kingdom at any 1 time, it is reasonable to assume that the disorder is sufficiently prevalent to recruit the required number of participants. Because those naming <10% of words will not be eligible for a further study, the recruitment rate of 1 to 2 participants per month seen in this study needs to be reduced to 1 per month to account for the additional exclusion criteria. This study suggested that recruitment rates reduce after a 12-month period when recruiting from this prevalent population, favoring an increase in number of regions involved rather than an increase in recruitment time to recruit the required number of participants. At a rate of 1 participant per month per site for a period of 12 months, the study would need to be conducted in approximately 15 regions across the United Kingdom, where a region includes a speech therapy department and voluntary-run communication groups in the area. With an SLT department in each major town/city and >150 voluntary communication groups in England, recruitment of 15 regions to recruit 12 participants each is likely to be achievable.

Limitations of the Study

The study was necessarily single-blinded because it is not possible to blind participants to whether they are receiving intervention with a computer. It is possible therefore that changes in the group who received computer treatment were influenced by their expectations that may have resulted from knowing they were receiving the treatment. Although the researcher conducting the outcome measures was blinded to the treatment allocation, it is acknowledged that blinding may have been broken by the presence of the computer or remarks made by the participant or caregiver during assessment of outcomes. This is something that may be accounted for in a larger trial by asking the researchers performing blinded outcome measures to record which treatment arm they thought the participant had been allocated to and match this with the actual allocation to identify the extent to which blinding had been successful.

Randomization to the treatment or usual care groups was stratified by aphasia severity based on subtests of the Comprehensive Aphasia Test, which include language domains such as verbal comprehension, reading, and writing. Because it is possible that individuals could be mild overall due to good comprehension but still have severely impaired word-finding ability, this could result in an uneven distribution of naming ability between the 2 groups. In a further study, randomization should therefore be stratified by naming severity rather than overall aphasia severity.

Quantitatively, an increase of 15% vocabulary is suggested to be clinically significant. However, use of new vocabulary in sentence structures and clinical usefulness of the treatment was not measured quantitatively in the pilot study but will be of interest in a future study.

The standard EQ5D test was reformatted to be more accessible for people with aphasia. However, this accessible version was not validated before the pilot and validation would be necessary if this is to be used to calculate QALYs in a further study.

Finally, size and location of the lesion would be of interest in predicting good responses to aphasia treatment. However, neuroimaging information was not required in this study because we recognize, outside of the acute stroke environment, that is, after discharge from the hospital, images are no longer readily accessible to patients or those involved in their long-term rehabilitation. Consequently, posthospital rehabilitation programs are likely to be designed in accordance with the presentation of the aphasia on psycholinguistic assessment. Given that most recovery occurs within the first 6 to 12 months, the question arises as to whether computer therapy should be studied from an earlier point in the rehabilitation process alongside face-to-face therapy, leading to continued self-managed computer treatment in the longer term.

In summary, the study demonstrates that self-managed treatment for continued improvement in aphasia using computer software is feasible when combined with a SLT to tailor appropriate exercises and a volunteer to offer ongoing support with computer practice and facilitate use of the new vocabulary in daily life. This study indicates that the intervention is potentially clinically and cost-effective and that it is feasible to conduct a large randomized controlled trial to provide robust evidence for this self-managed computer treatment for aphasia.

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Disclosures

J.M. is a director of Steps Consulting Ltd.

References

ONLINE SUPPLEMENT

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Supplemental table S1. Baseline characteristics of participants’ aphasia

Supplemental figure S2. Relationship between practice time and change in naming
Supplemental table S1. Baseline characteristics of participants’ aphasia based on subtests of the Comprehensive Aphasia Test¹

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control group (n=17)</th>
<th>Intervention group (n=16)</th>
</tr>
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Supplemental figure S2.

Reference