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# Tele-Rehabilitation: Redefining Stroke Early Supported Discharge During the COVID-19 Pandemic

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**Abstract**

***Aims***

To explore the usability of tele-rehabilitation among stroke survivors receiving Early Supported Discharge (ESD) during the COVID-19 pandemic.

***Methods***

A cross-sectional study using purposive sampling was conducted to recruit stroke survivors (≥18) who engaged in at least three tele-rehabilitation sessions with a regional ESD team between March-July 2020. Patients completed a modified five-point Telehealth Usability Questionnaire (TUQ), online or via post. Responses were scored from one (strongly disagree) to five (strongly agree).

***Results***

In total, 27 (79%; 27/34) patients completed the survey. The median age (±interquartile range) was 67 (±12). The majority were male and had suffered an ischemic, left hemispheric stroke. The overall median TUQ score was 4 (±1). The highest rated subcategory was *'usefulness'* (4.3±1); and the lowest was *'reliability'* (3.67±0.67). Patients aged ≥70 had a significantly lower total median score (4±0) than those <70 (5±1), p=0.04. However, this related exclusively to the *'ease of use and learnability'* domain (p=0.03). No statistically significant difference by age was detected in other domains.

***Conclusion***

Stroke survivors receiving ESD during this pandemic found tele-rehabilitation acceptable. Older stroke survivors (≥70) were equally satisfied, suggesting age is not a barrier to tele-rehabilitation but they may require support to improve ease of use.

**Keywords:** COVID-19, stroke, early supported discharge, tele-rehabilitation, e-Health, virtual

## Introduction

The COVID-19 pandemic swiftly transformed the delivery of health services across all care settings. There was an increasing need to discharge patients from hospitals due to the high rates of transmission and increasing need for bed capacity. This expedited the use of electronic health (e-Health), also known as digit health, combining the use of electronic information and communication technology to support patient care and treatment[1]. Stroke continued to occur at the same or greater rate during the pandemic[2]. For stroke survivors, this often resulted in an accelerated transition from hospital to home to minimize risk of nosocomial infection, especially for those who met the criteria for Early Supported Discharge (ESD) programmes[3]. Stroke ESD is a model of international best practice for stroke rehabilitation and restoration of living[3]. It is an alternative to inpatient rehabilitation through the provision of stroke-specific rehabilitation in the patient's home for those with mild to moderate disability post stroke. ESD facilities faster discharge home and improved patient outcomes[4]. It can be expected to improve functional ability, independence, and quality of life, while reducing the likelihood of long-term institutional care[4].

Tele-rehabilitation, which is a form of e-Health, refers to the use of information and communication technologies to provide services to patients in their own homes or other remote locations[5]. For the purpose of this study, the service delivered was stroke rehabilitation. Therapists can provide this in a variety of ways, most commonly, two-way real-time visits with audio, video, or both synchronously. Due to the COVID-19 pandemic, ESD teams in Ireland and the United Kingdom were encouraged to engage in tele-rehabilitation, where possible[6]. Evidence suggests tele-rehabilitation is comparable to in-person therapy in community stroke settings with sub-acute and chronic stroke survivors[7-8]. However, the translation of tele-rehabilitation into clinical practice remained slow until this pandemic, which stimulated a major shift towards e-Health.

Evidence to support the use tele-rehabilitation for delivering ESD rehabilitation to stroke survivors who are still in the acute phase of recovery is lacking. Evaluating the acceptability and feasibility of tele-rehabilitation interventions from a user perspective is critical[7]. This study, therefore, aims to explore the usability of tele-rehabilitation with stroke survivors availing of an ESD service during the COVID-19 pandemic.

## Methods

A cross-sectional descriptive study was conducted using an anonymous online or postal survey. Purposive sampling was employed to recruit all English-speaking patients aged $\geq$18 who participated in at least three tele-rehabilitation sessions with the ESD team at the beginning of the COVID-19 pandemic in Ireland.

The sample (n=34) consisted of those that met the eligibility criteria between March and July 2020. This allowed the team to evaluate the reconfiguration of ESD stroke rehabilitation during the initial wave of the pandemic. The mode of survey completion was based on the patients preferred communication methods with the ESD team, namely post or email. Surveys were returned anonymously online or with a stamped addressed envelope provided, therefore, it was not possible to present information related to those who did not complete the survey.

The ESD team provides physiotherapy, occupational therapy and speech and language therapy to stroke survivors referred from two university teaching hospitals in the South of Ireland. Tele-rehabilitation consisted of therapists providing stroke rehabilitation to patients via a video calling platform. Tele-rehabilitation sessions lasted on average 45 minutes to one hour. The number of sessions per week varied depending on patients' goals and the intensity of therapy required. Patients were invited to complete a modified version of the Telemedicine Usability Questionnaire (TUQ) and provide their baseline characteristics[10]. Permission was obtained from the authors of the TUQ to reduce the Likert scale by two points. The five-point Likert scale ranged from 'strongly agree' to 'strongly disagree' has been recommended by the researchers to reduce the frustration level and cognitive burden on respondents while increasing response rates and quality. Response options were 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly disagree.

The TUQ was designed to be a comprehensive questionnaire that addresses factors related to telehealth or e-Health across five domains: usefulness, ease of use and learnability, quality, reliability, and satisfaction and future use. Participants were asked to indicate the usability of tele-rehabilitation across these five domains giving a total of 21 items with a max score of five for each item. '*Usefulness'* refers to the participants' perception of how tele-rehabilitation provides access to rehabilitation including whether it saves time and/or provides for their needs. *'Ease of use and learnability'* refers to the how quickly and simply the system employed to participate in tele-rehabilitation can be learned to use. *'Quality'* refers to the quality of the interaction, particularly related to participant being able to express themselves and to see, hear and talk to the therapist easily through the interface. *'Reliability'* refers to how easily the participant can recover from an error and how the system provides guidance on this. *'Satisfaction and future use'* relates to overall satisfaction of the participant with tele-rehabilitation and how willing they would be to participate in this type of rehabilitation again.

Ethical approval was obtained, and data were collected over a two month period (August and September 2020). All participants were discharged from the ESD programme at the time of data collection.

Descriptive statistics including percentages and frequencies were calculated using IBM SPSS 25.0. Numerical data were non-normally distributed. Median and interquartile ranges (IQR) were therefore reported. Relationships between groupings were examined using the Mann-Whitney U and Chi-squared Test for Independence. A significance level of $p<0.05$ was set for all statistical tests.

**Results**

A total of 42 stroke patients participated in ESD between March and July 2020 with 34 patients (81%) meeting the above inclusion criteria. There was a 79% (27/34) response rate to participate in this survey. Participant demographics and clinical characteristics are presented on Table 1. The majority of respondents were male (74%; 20/27); with a median age of 67 (IQR±12).

Most participants had an ischaemic stroke (85%; 23/27), affecting their left hemisphere (63%; 17/27). The median time interval between the stroke and initiation of therapy with the ESD team was eleven days (±17). There was no statistically significant difference between the demographics of those who participated in tele-rehabilitation compared to the overall ESD patient cohort from March to July 2020. The median number of tele-rehabilitation sessions varied between therapies; physiotherapy 11.5 (±11.25), speech and language therapy 7 (±4), occupational therapy 4.5 (±6.5). Median scores on the TUQ are displayed in Table 2. Overall, based on the total median score, the majority found tele-rehabilitation usable, despite 56% of participants requiring another person to help access the platform or set up the device. The domain with the highest median score was *'usefulness'* (4±1). In all, most (78%; 21/27) patients agreed or strongly agreed that tele-rehabilitation improved their access to healthcare. While 48% (13/27) agreed or strongly agreed that tele-rehabilitation was the same as in-person visits, the *'reliability'* domain had the lowest median score (3.67±0.67) with almost one-third, 30% (8/27) of participants disagreeing that it was equivalent. When the cohort was dichotomised by age, those aged <70 years provided significantly higher median scores compared to those ≧70 years: 5 (±1), versus 4 (±0), p=0.04. By domain, only the *'ease of use and learnability'* category produced a significant difference (p=0.03) with the younger cohort reporting tele-rehabilitation easier to use.

***Table 1:*** *Participant demographics and clinical characteristics, comparing participants in the survey and the overall cohort receiving early supported discharge (ESD).*

| **Variable** | **Participants in Survey** (n=27) | **Overall ESD Cohort** (n=42) | **P value** |
|---|---|---|---|
| **Age** (years)<br>Median (Q3-Q1=± IQR) | 67 (73.5-61.5=±12) | 67 (75-60=±15) | p=0.685 |
| **Gender**<br>(% Male) | 74% (20/27) | 69% (29/42) | p=0.653 |
| **Type of stroke**<br>(% Ischaemic) | 85% (23/27) | 86% (36/42) | p=0.722 |
| **Side of stroke**<br>(% Left) | 63% (17/27) | 62% (26/42) | p=0.532 |
| **Living arrangements**<br>(% Living Alone)<br>(% Living with family or friends) | 11% (3/27)<br>89% (24/27) | 10% (4/42)<br>91% (38/42) | p=0.831 |
| **Living area**<br>(% Urban)<br>(% Rural) | 70% (19/27)<br>30% (8/27) | 79% (33/42)<br>21% (9/42) | p=0.44 |
| **ESD length of stay**<br>Median (Q3-Q1=± IQR) | 37 (56-25.5=30.5) | 36 (52-21=±31) | p=0.53 |
| **Tele-rehabilitation** | | | |
| **Number of tele-rehabilitation sessions**<br>Median (Q3-Q1=± IQR)<br>Physiotherapy<br>Occupational Therapy<br>Speech and Language Therapy | 11.5 (14.75-3.5=11.25)<br>4.5 (9.25-2.75=6.5)<br>7 (8-4=4) | | |
| **Did someone at home help you with the tele-rehabilitation?**<br>(% Yes)<br>(% No)<br>(% Sometimes) | 56% (15/27)<br>37% (10/27)<br>7% (2/27) | | |

***Table 2:*** *Telemedicine Usability Questionnaire (TUQ) total and items scores for the survey participants, comparing those aged under and over 70 years.*

| **TUQ Items** | **Total** (n=27) Median score (Q3-Q1=± IQR) | **Aged <70 years** (n=15) Median score (Q3-Q1=± IQR) | **Aged ≥70 years** (n=12) Median score (Q3-Q1=± IQR) | **P value** |
|---|---|---|---|---|
| **Total** | 4 (5-4=1) | 5 (5-4=1) | 4 (4-4=0) | p=0.04 |
| **Usefulness** | 4.3 (5-4=1) | 4.67 (5-4=1) | 4 (4.67-3.83=0.84) | p=0.12 |
| **Ease of use and learnability** | 4 (4.46-4.0=0.46) | 4.33 (4.67-4=0.67) | 4 (4-3.67=0.33) | p=0.03 |
| **Quality** | 4 (4.75-3.8=0.95) | 4.6 (4.9-3.9=1) | 4 (4.3-3.8=0.5) | p=0.16 |
| **Reliability** | 3.67 (4-3.33=0.67) | 3.67 (4.5-3.33=1.17) | 3.67 (3.83-3.17=0.66) | p=0.27 |
| **Satisfaction and future use** | 4.13 (4.75-4=0.75) | 4.5 (5-4=1) | 4 (4.25-4=0.25) | p=0.14 |
| Q = Quartile; IQR = Interquartile range | | | | |

**Discussion**

This study found that tele-rehabilitation is an acceptable means of delivering therapy to stroke survivors as part of an ESD programme during a global pandemic. To the best of our knowledge, this is the first study exploring tele-rehabilitation as a means of delivering stroke rehabilitation, both this early in the recovery phase and during the COVID-19 pandemic.

Results from this representative cohort are consistent with two large studies across other medical fields, which revealed high levels of satisfaction with video conferencing as an alternative to in-person appointments during COVID-19[11-12]. However, further research is warranted to test this hypothesis and the effectiveness of ESD tele-rehabilitation in a larger cohort of stroke survivors in Ireland in comparisons to other models of delivery.

The TUQ is a valid instrument for this purpose and has been used in similar studies. A study of patients receiving otolaryngology services in the United States during the pandemic also found the *'reliability'* domain of the TUQ was the lowest scoring category[11]. '*Reliability*' includes a question probing whether respondents regard tele-rehabilitation to be as reliable as in-person visits. The importance of in-person visits and using tele-rehabilitation in a supplementary capacity with older adults receiving tele-rehabilitation on discharge home from hospital has been previously recognised[13]. This may potentially explain why the *'reliability'* domain scores were lower than other domains in this sample. Tele-rehabilitation alone may not be reliable enough for all rehabilitation situations. That said, the digital trends in Ireland survey in 2018 highlighted that six out of ten people have used an emerging digital technology such as virtual services[15]. This suggests that there was already some acceptance of digital technologies before the pandemic. Accessibility of digital health is also limited by connectivity. Some individuals living in rural areas might not have access to high-speed broadband, which is currently being addressed in line with the National Broadband Ireland plan[16]. Further qualitative research is required to explore, in depth, the elements of rehabilitation that are deemed essential by patients receiving ESD for in-person completion and the acceptability of tele-rehabilitation beyond the pandemic.

Age can be a barrier to engaging in tele-rehabilitation[14]. While the results suggest that it is generally acceptable to older stroke survivors (≧70), the need to support them to engage in tele-rehabilitation is a key learning point from this current study. The TUQ explored the ease of use of tele-rehabilitation including the ability to follow (see and hear) the clinician along with being able to express one's self clearly. Tele-rehabilitation systems need to be easy to learn and use to support older adults in engaging in tele-rehabilitation[13]. More than half the stroke survivors required assistance from another person to facilitate the video calling and only a small number lived alone. It is important to consider, in the context of a global pandemic, that many people may not be working or instead working from home, meaning that more people (e.g. family) were available to support stroke survivors with tele-rehabilitation. The requirement for a carer to facilitate the video call necessitates attention when considering the delivery of tele-rehabilitation beyond the pandemic[17]. Multimodal resources, such as aphasia friendly graphics and large text, can enable stroke survivors, regardless of age or level of impairment, to participate in tele-rehabilitation[17]. Involving the public and patients along with other key stakeholders in the development, improvement and evaluation of tele-rehabilitation services is vital to guide its successful implementation and maintenance beyond the COVID-19 pandemic.

The small sample size and specificity to an ESD cohort limit generalisability of results. Those who were unable to participate in tele-rehabilitation were excluded, which may have skewed results in favour of agreement. This study was conducted during a global pandemic where in-person therapy sessions were minimised in the interest of public health. It is unclear if tele-rehabilitation would be as acceptable outside this context. Comparison between both modalities is required to examine the sustainability of tele-rehabilitation.

To conclude, tele-rehabilitation was acceptable to stroke survivors participating in an ESD rehabilitation programme in Ireland during the ongoing COVID-19 pandemic. It was deemed useful, reliable, and satisfactory by most stroke survivors, irrespective of age, although older adults may have more difficulty with its use. The rapid engagement from stakeholders is encouraging. Further research is warranted to explore how to support ease of use for older adults, to identify what elements of rehabilitation are essential to complete in-person and to evaluate acceptability beyond the COVID-19 pandemic.

**Declaration of Conflicts of Interest:**
The authors declare that there are no conflicts of interest.

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