Telerehabilitation for stroke patients: an overview of reviews

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ABSTRACT

The increasing number of survivors following stroke events are enlightening new needs to guarantee appropriate care and quality of life support at home. A potential application of telemedicine is to exploit home care and rehabilitation. Within the framework of an EU FP7 project called Integrated Home Care (IHC) we performed an overview of reviews on the telefacilities for the homecare in stroke patients, in order to plan a clinical trial. A broad literature research was conducted in PUBMED, Web of Science® and The Cochrane Library databases. We included and graded all the reviews matching the following criteria: published in English in peer-reviewed journals, targeting stroke as adult patients (age>18yr.) and considering a homecare setting in the intervention. 6 full-text reviews were included: 1 systematic review with meta-analysis and 5 non-systematic reviews. Despite the absence of adverse effects, no conclusions can be stated on the effectiveness of telerehabilitation compared to other home treatment, due to the insufficient data available, nevertheless strong indications emerged for the inclusion of “all cause mortality” and “hospital admission” as primary outcomes. Besides “QoL”, “cost”, “adherence” and “patient acceptability” should be included as secondary outcomes, for a complete evaluation of the tele-intervention. This indications should be considered as relevant in planning a telerehabilitation trial, in order to observe the expected effectiveness from a multidimensional point of view in the clinical, financial and social perspectives.

1. INTRODUCTION

The increasing number of survivors following an acute event like stroke and the consequent improvement in their life expectations are enlightening new needs to guarantee appropriate care and quality of life support at home.

The World Health Organisation (WHO) Europe Regional Office considers as a critical issue in Western-countries the fragmented delivery of health and social services.

Disease management has shown great promise as a means of reorganizing chronic care and optimizing patient outcomes. Nevertheless, disease management programs are widely heterogeneous and lack a shared definition, which limits our ability to compare and evaluate different programs. To address this problem, the American Heart Association’s (AHA) Disease Management Taxonomy Writing Group [Krumholz, 2006] developed a system of classification (Figure 1) useful to categorize and compare disease management programs and also to inform efforts to identify specific factors associated with effectiveness.
Following the AHA taxonomy we can define the telefacilities in homecare with a broader meaning like the “home-based remote monitoring and treatment of chronic patients delivered by healthcare professionals, through internet and communication technologies (ICT), with different intensity and complexity, in order to improve both objective and subjective outcomes”.

In recent years, the increasing availability of low costs ICT gave the opportunity to explore the effectiveness of technology solutions in providing health services within and outside the hospitals, with a consequent increasing interest for telemedicine in the rehabilitation/care field, thus the telerehabilitation and telecare are emerging as new branches of the telemedicine [Botsis, 2008].

Continuity across primary and secondary settings is mainly assured by integrated forms of care: telemedicine has been advocated as a possible technological, managerial and economic support for health service integration. A potential application of telemedicine is to exploit home care and rehabilitation of people impaired by neurological diseases such as stroke [Craig, 1999; Craig, 2000].

Telerehabilitation is defined as the remote delivery of rehabilitative services through internet and communication technology (ICT) [Rosen, 2004]. Telemonitoring (patient functioning assessment and clinical management), teletherapy, teleconsultation, telementoring and teleducation are possible provided services directed to patients and mediated by professionals and caregivers.

A number of trials have been published to primarily test the feasibility of telerehabilitation and telemedicine homecare approaches and to compare their effectiveness to standard home rehabilitation/care [Hermens, 2008; Hill, 2009; Piron, 2008; Piron, 2009; Schein, 2010].

A Cochrane review on possible interventions [Currell, 2000] has already explored the effectiveness of the professional practice and health care outcomes in the use of telemedicine compared to face to face patient care, nevertheless the authors couldn’t perform a meta-analysis due to the high heterogeneity in the few studies included.

The authors concluded that using telecommunications technologies is feasible, but there is little evidence of clinical benefits, moreover no analysable data exist about the cost effectiveness of telemedicine systems, with a consequent warning for the policymaker to recommend a broader use and investment in unevaluated technologies.

In order to understand the actual magnitude of telerehabilitation benefits and eventual harms when compared to standard home rehabilitation/care and to plan with meaningful outcomes a clinical pilot trial on the tele-treatment at home for patients affected by stroke, we summarized the body of evidence on the telerehabilitation approaches by means of an overview of reviews.
2. MATERIAL AND METHODS

2.1 Search Strategy

To include the major number of papers on telefacilities in integrated care for stroke patients, a broad search strategy, with no limits applied, was run in the databases PUBMED, Web of Science® and The Cochrane Library including the mesh terms: “tele*”, “telecare”, “telemedicine”, “homecare” and “stroke” combined with different Boolean operators.

2.2 Selection Criteria and Analysis

To be included in this overview the selected reviews needed to meet the following criteria.

- language of publication was English;
- the targeted populations must include stroke patients;
- the patients enrolled in the study should be adult, namely with an age > 18 yrs;
- a home care setting considered in the interventions;
- full-text articles in peer-reviewed journals.

The reviews not addressing telemedicine in stroke patients and focused on caregivers or professionals instead of patients directly were excluded.

The included reviews were rated respectively as high, moderate or low by means of a methodological criteria, in order to grade the quality of evidences:

- HIGH: systematic review with meta-analysis
- MODERATE: systematic review without meta-analysis
- LOW: non-systematic review

Descriptive data (author; year of publication; pathologies included; intervention; evidences) was extracted by all the reviews included. The findings were summarized into descriptive tables displaying the main data.

3. RESULTS

The literature search led to 414 potential relevant records in PUBMED (9.4%), Web of Science® (84.6%) and The Cochrane Library (6.0%) (Table 1).

Table 1. Bibliographic search strategy.

<table>
<thead>
<tr>
<th>DATABASE</th>
<th>SEARCH STRATEGY</th>
<th>No OF ARTICLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PUBMED</td>
<td>tele* AND care AND stroke</td>
<td>39</td>
</tr>
<tr>
<td>Web of Science®</td>
<td>tele* AND care AND stroke</td>
<td>350</td>
</tr>
<tr>
<td>The Cochrane Library</td>
<td>telecare</td>
<td>5a</td>
</tr>
<tr>
<td>The Cochrane Library</td>
<td>homecare</td>
<td>7a</td>
</tr>
<tr>
<td>The Cochrane Library</td>
<td>telemedicine</td>
<td>13a</td>
</tr>
</tbody>
</table>

From the overall relevant studies we excluded all those not reporting a review and not published in English, resulting in 49 records whose abstract were screened following the selection criteria. Finally 6 full-text reviews were included in the overview (Figure 2).

The publication year ranged from 2003 to 2006 and the records included comprised: 1 systematic review with meta-analysis (16.7%), 5 non-systematic review (83.3%) and no systematic review without meta-analysis. Regarding the targeted populations, the only systematic review with meta-analysis compared different telemedicine approaches with usual care not only in stroke but also in HF patients, while in the non-systematic reviews subgroup all the 5 records were targeted only to stroke patients.
3.1 Interventions

Different kind of remotely controlled interventions at home were extracted from the analysis of reviews that confirmed the outstanding different approaches to telecare in the management of stroke diseases, after discharge.

It was possible to extract evidences on telerehabilitation interventions for stroke patients intended as:

- telephone follow-up (TFU),
- interaction with devices based on position/sensing technologies,
- remote control of devices based on position/sensing technologies
- remote control and interaction with virtual reality based devices.

Considering the heterogeneity in the different approaches to telerehabilitation interventions, it was not possible to plan a comparison of the results form different reviews.

3.2 Summary of the Evidences

3.2.1 High quality evidences (the study details are reported in Table 2). In HF and STROKE patients:

- Case management interventions providing also TFU were associated with the reduction in the overall mortality in HF patients, especially in high quality study (odds ratio 0.68, 95% confidence interval 0.46 to 0.98, P=0.04), but it is unclear which are the effective components involved in the case management interventions. Moreover TFU in HF and STROKE patients showed clinically-equivalent results compared to control groups due to the low methodological quality of the studies specifically designed for this comparison. TFU couldn’t be associated specifically with the reduced mortality in HF and STROKE patients.

3.2.2 Low quality evidences (the study details are reported in Table 3). In STROKE patients:

- The utilization of telemedicine is recommended to increase the delivery of evidence-based stroke treatments.
- There are still insufficient data about the use of telemedicine in stroke prevention, rehabilitation and post-stroke care.
Telerehabilitation interventions using VR have been improving post-stroke patients outcomes, however few data are available at this time.

Telemedicine might become a viable option in remote areas.

Developing of a successful implementation of a home-based rehabilitation system is making technology reliable and blind to the user.

Great potential is foreseen if the cost of the system is reduced.

Table 2. Summary of findings from systematic reviews with meta-analysis.

<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>YEAR</th>
<th>PATHOLOGY</th>
<th>INTERVENTION</th>
<th>EVIDENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mistiaen</td>
<td>2006</td>
<td>HF; STROKE</td>
<td>telephone follow-up (TFU)</td>
<td>The low methodological quality of the included studies means that results must be considered with caution. No adverse effects were reported. Nevertheless, overall the studies show clinically-equivalent results between TFU and control groups. Overall, there was inconclusive evidence about the effects of TFU.</td>
</tr>
</tbody>
</table>

Table 3. Summary of findings from non-systematic reviews.

<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>YEAR</th>
<th>PATHOLOGY</th>
<th>INTERVENTION</th>
<th>EVIDENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audebert</td>
<td>2009</td>
<td>STROKE</td>
<td>telemedicine</td>
<td>The utilization of telemedicine is recommended to increase the delivery of evidence-based stroke treatments. In this context, telemedicine can play a critical role, particularly in neurologically underserved areas. There are still insufficient data about the use of telemedicine in stroke prevention, rehabilitation and post-stroke care.</td>
</tr>
<tr>
<td>Misra</td>
<td>2005</td>
<td>STROKE</td>
<td>telemedicine</td>
<td>In remote area telemedicine may become a viable option</td>
</tr>
<tr>
<td>Zheng</td>
<td>2005</td>
<td>STROKE</td>
<td>Telerehabilitation position/sensing technologies based</td>
<td>Developing of a successfull implementation of a home-based rehabilitation system is making technology reliable and invisible to the user, so that it is simple to attach and use.</td>
</tr>
<tr>
<td>Holden</td>
<td>2005</td>
<td>STROKE</td>
<td>Telerehabilitation Virtual Reality based</td>
<td>The field of telerehabilitation is in its infancy, but has great potential, especially if system cost can be reduced.</td>
</tr>
<tr>
<td>Burdea</td>
<td>2003</td>
<td>STROKE</td>
<td>Telerehabilitation Virtual Reality based</td>
<td>Telerehabilitation interventions using VR has been improving post-stroke patients, however less data is available at this time.</td>
</tr>
</tbody>
</table>

4. CONCLUSIONS

The state of the evidence emerging from this overview should be considered in planning trials on tele applications to provide rehabilitation services in homecare. Nevertheless it should be considered that the few indications emerging from the summarized data seem to be weak as based mainly on non-systematic reviews.

In stroke patients, it should be preferred an on-line interactive device (allowing also videoconference) than a store and forward device in order to provide the tele-intervention.

Primary outcomes like “overall mortality” and “hospital admission” should be included to prove the effectiveness of interventions; moreover secondary outcomes like “QoL,” “cost,” “adherence” and “patient
acceptability” should be taken into consideration to perform a complete analysis of the telecare approach choices.

The above indications should be considered as relevant in trials planning, in order to demonstrate from a multidimensional point of view the effectiveness of telerehabilitation in clinical, financial and social perspective. One of the main issue in dissemination of telerehabilitation mainly relies on the differences in recognizing, by policy maker, this service as a reimbursable one.

Regarding the systematic analysis of the literature, the methodology, in designing studies targeted to stroke population, should improve in order to obtain a more complete framework of the effectiveness of telemedicine as a useful intervention in the homecare of neurological conditions.

Acknowledgements: this study was supported by the FP7 – EU Project “Integrated Home Care” (Grant agreement n° 222954). http://www.integratedhomecare.eu/

5. REFERENCES

P Mistiaen, E Poot (2006) Telephone follow-up, initiated by a hospital-based health professional, for postdischarge problems in patients discharged from hospital to home, Cochrane Database Syst Rev, 18, 4, pp. CD004510.