MY WAY
A EUROPEAN COLLABORATIVE AND INNOVATIVE PARTNERSHIP TO PROMOTE PHYSICAL ACTIVITY AFTER STROKE EVENT

INTELLECTUAL OUTPUT 2
Identification of good practices

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613107-EPP-1-2019-1-IT-SPO-SCP

Co-funded by the Erasmus+ Programme of the European Union

THIS OUTPUT HAS BEEN REALISED WITH THE CONTRIBUTION OF ALL THE PROJECT PARTNERS:

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INTRODUCTION

Project background

The MY WAY project has the aim to develop, implement and transfer innovative practices related to physical activity and exercise enhancing health in post-stroke patients. An important part of this strategy is the identification and analysis of good practices and strategies to encourage participation in sport and physical activity, engage and motivate stroke patients to perform physical activity changing their lifestyle and to maintain a high adherence to physical activity programs and therefore to increased levels of participation in physical activity among the project target groups.

Due to the ageing of the European population and the strong association between stroke risk and age, the number of people who had a stroke is rising. Together with the welcome improvement in the survival rates, the number of people who have had a stroke and have to live with its consequences needing specialist supportive care and rehabilitation, is increased. The stroke survivors can experience a wide range of negative physical and mental consequences that are long-lasting, including problems with mobility, vision, speech and memory; personality changes; cognitive impairments; fatigue; and depression. Post-stroke problems affect patients' ability to complete daily activities at home and to participate in the community.

Rehabilitation aims to enable people with disabilities to reach and maintain optimal physical, intellectual, psychological and/or social function. A key characteristic of stroke units is rehabilitation delivered by a specialized multidisciplinary team. The composition of these teams is not formally prescribed, but usually includes PRM (physical and rehabilitation medicine) physicians, trainers, nursing staff, physiotherapists, occupational therapists, and speech and language therapists. European stroke care guidelines make recommendations for the elements of rehabilitation, although there is not enough evidence to be certain about what exactly the therapies should consist of. Nevertheless, physical activity and exercise are highly recommended in the chronic phase to sustain functions gained in rehabilitation and as part of long-term secondary prevention to reduce the risk of recurrent stroke and other vascular events. Hence, development of new interventions is needed to help stroke survivors live a more active lifestyle to maintain the functional levels achieved during stroke unit treatment and early post stroke rehabilitation.

The number of people having a stroke and the number of people living with the long-term effects of stroke will rise in the coming decades. Effective health care planning and adequate resource allocation across Europe is needed to deal with this. However, there is wide variation across Europe in how well

countries meet their targets for long-term exercise-based rehabilitation. The variation in access to long-term exercise-based rehabilitation between and within countries is due to different organization of stroke services, different strategic approaches and different levels of resources. One main goal of the project consortium is to identify interventions that could be effective once introduced in real life, first of all in the partner countries.

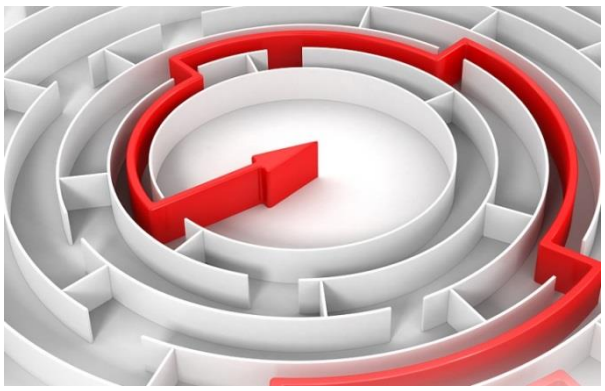
Detailed information about the MY WAY project is available on its official website at https://www.myway-project.org/.

Identification of Good Practices

According to MY WAY's objectives, the identification and analysis of good practices for long-term exercise-based rehabilitation is an important activity of the MY WAY project, covering an entire work package (WP4). The analysis of good practices will explore promoting and inhibiting factors of physical activity and exercise in stroke patients through a literature review of international publication databases and the collection of successful and unsuccessful local experiences.

The local context is fundamental to allow the understanding of the general framework of the topics, taken into consideration the literature review and the evaluation of previous experiences. The conclusion of the analysis of local context could be transferred to other contexts; the analysis of good practices is the basis for the activities in this project and the replication of the project in other countries.

Each partner identified good practices in the project field, exploring in its country promoting and inhibiting factors of physical activity and exercise in stroke patients, through an analysis of successful and unsuccessful local experiences and based on a wide literature review of international publication databases, to find for the different European local contexts cost-effective and applicable solutions.



methodology we have used in relation to the three steps mentioned above.

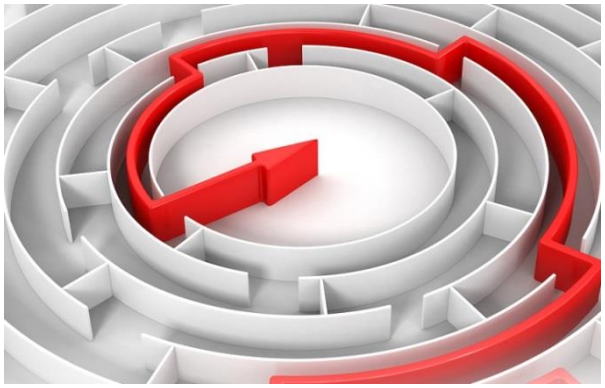
METHODOLOGY

The report is based on the identification and analysis of good practices. Good practices have been collected through literature review of international publication databases and directly from partner countries through their own research.

The collection and analysis of good practices has been performed in three steps:

1. Interventions of international literature database origin have been surveyed through a detailed literature review. As a result of this process, 13 reports have been prepared, each of them presenting an intervention.
2. MY WAY project partners have been asked to assess these interventions along several indicators. The analyses of these evaluations are included in Chapters 3 and 4.
3. MY WAY project partners have been asked to collect recent interventions from their own national context. The analyses of these interventions are included in Chapter 5.

Subsequently, we are going to describe the



Literature review

As a first step, toward identifying good practices in long-term exercise-based stroke rehabilitation the MY WAY consortium performed a comprehensive literature review.

Our priority was to identify as many interventions as possible. The only criterion we have used at this first stage was the following: an intervention would qualify, if enough material can be found about it in English for the preparation of a summary.

We searched white literature through PubMed and also performed free internet search. The search strategy and plan were developed with some “search terms” (stroke, cerebrovascular accident +/- patients +/- country or region name + keyword or combination of keywords of interest; rehabilitation; physical activity; exercise; training; intervention; mobility; physical training; long-term rehabilitation; walking; balance; etc.) identified.

The sources for information were articles concerning randomized controlled trials published in peer-reviewed journal and their reference lists. We intended to analyze mainly European interventions, but we managed to identify approximately 30 programs implemented in developed countries worldwide.

In the second stage, our task was to narrow the number of interventions and pick the ones that best suited for our analysis purposes. During the selection process we applied set criteria. Finally chosen interventions needed to:

- include a comprehensive evaluation system, preferably based on quantifiable results,
- provide at least some basic information about the following: intervention design, people involved, identified barriers, sustainability and transferability,
- be designed in a prospective way,
- contain any new idea or element that has given a positive result in the field of physical activity and exercise in stroke patients,
- contain outcome data and comparison group.

Finally, we selected 13 interventions and prepared a short report about each. Appendix 1 contains a summary of each intervention.

Analysis of the literature review interventions

For each intervention a set of features was also collected:

- Date of intervention
- Country of intervention
- Intervention/control group size
- Gender mix
- Intervention length
- Assessment periods
- Outcome measures
- Limitations

Then, a questionnaire has been prepared for MY WAY project partners to evaluate the 13 selected interventions (the questionnaire template is available in Appendix 2).

All MY WAY partners filled out a questionnaire for each intervention. The result was 65 completed questionnaires ready for analysis.

The answers collected from the questionnaires together with the above data formed the basis of the analysis. This body of information was assigned to and processed along four previously identified dimensions: relevance, quality, effectiveness and sustainability. We introduced a weighted scoring system to obtain an objective evaluation system, each indicator summing up to 100 points.

Apart from analyzing the numbers and scores, a thorough examination of intervention texts and answers to elaborative questions were the basis of non-quantifiable insights. The results of textual analysis can be found in the ‘Descriptive analysis’ subchapters.

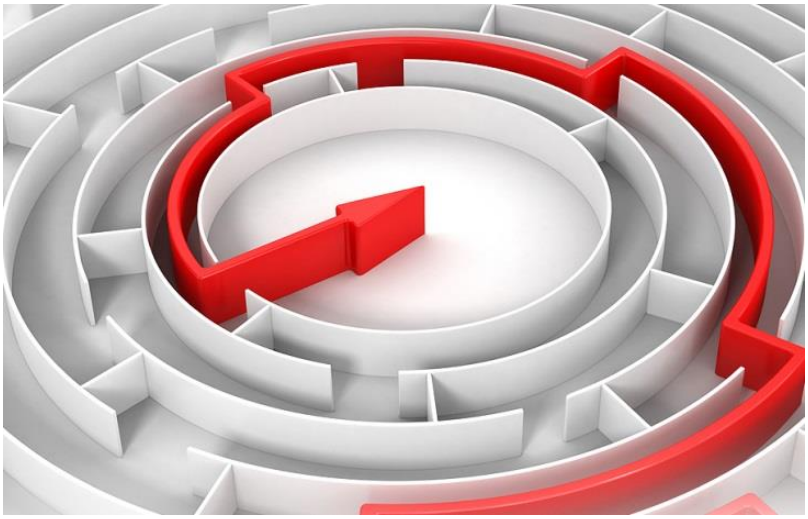
Qualitative and quantitative analysis together provide a wealth of conclusions from the interventions.

Partner country interventions

One main goal of the project consortium was to identify interventions that could be effective once introduced in real life, first of all in the partner countries. National differences naturally exist and it is highly important to differentiate between stroke environments – the one is suitable in Italy, but not executable in Croatia or Lithuania or conversely.

A questionnaire has been prepared for MY WAY project partners aimed at collecting recent interventions from their own national context (see all the completed questionnaire in Appendix 4). Each partner was asked to fill in a minimum of two questionnaires, but they were encouraged to provide as many as possible. As a priority, the main criterion was to include interventions related to long-term exercise-based post-stroke rehabilitation programs. Furthermore, the intention was to cover different kind of exercise-based programs that constitute good practices related to physical activity/exercise/sports enhancing all aspects of health in post-stroke patients. Partners were encouraged to choose and analyze randomized controlled trials published in peer-reviewed scientific journals. However, practical and concrete actions were also accepted.

In addition, partners completed a matrix that was created to insert all the gathered information about their local contexts to make them comparable, where possible. The questionnaire aimed to reveal what initiatives could be useful in each country to increase stroke patients' effective participation in exercise activities. Our aim was to identify good examples, but not to represent the state and development level of a country's stroke management system. For analysis purposes we have created an objective scoring system, based on the facts provided in the descriptions regardless of the intervention type.



RESULTS OF LITERATURE REVIEW ANALYSIS

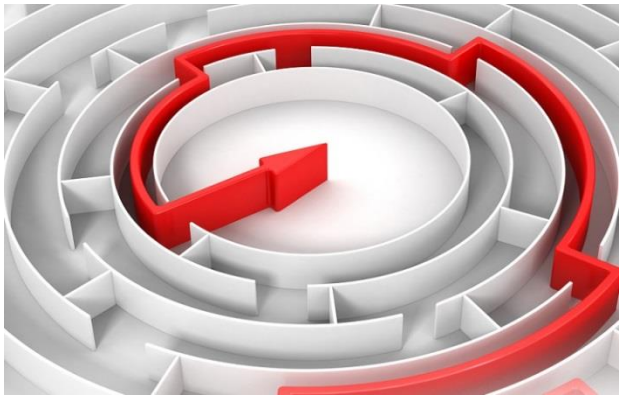
The selected 13 international interventions covered different kinds of programs that constitute good practices related to physical activity enhancing health in post-stroke patients.

We are well aware that there are a lot of features that are not present in these 13 reports. While these might be interesting as good examples, we are positive that we still managed to highlight several important associations within these limitations.

Publication dates are between 2011 and 2020. The average publication year is 2017 and 12 interventions are recent (within five years). However, territorial distribution shows that more than half of the studies are of non-EU origin (9 out of 13), though one main aspect of the literature analysis was the selection of EU-studies. This fact itself should be more than alarming to stakeholders to start designing interventions and studies aiming to promote the long-term exercise-based post-stroke rehabilitation programs.

We have to mention at this point that unified European stroke long-term rehabilitation guidelines do not exist. European Stroke Organization (ESO) already formulated recommendations but not widely practiced in the EU Member States.

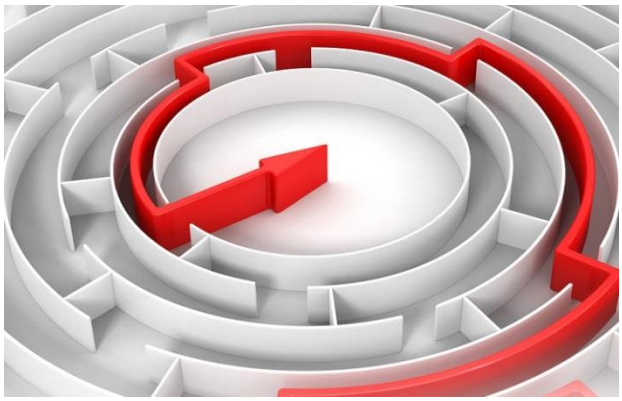
Though numerous evidences support that secondary and tertiary preventions have the biggest impact on health, apparently few interventions are performed. There is a trend in global health care, exercise-based rehabilitation becoming more popular that will hopefully have a positive effect on the number and quality of initiatives aimed at improving current long-term exercise-based. The MY WAY project fits well into this emerging trend.



ANALYSIS BY INDICATORS

International interventions have been analyzed along four dimensions. This chapter examines these dimensions one by one, both from quantitative and qualitative perspectives. The structure of the subchapters follows the same pattern:

1. In the introduction, the definition for the specific category is provided and the source of the data that formed the basis of the analysis is described.
2. Scoring analysis presents conclusions from quantitative results, highlighting common trends and uncovering relations – deduced from statistical calculation.
3. Descriptive analysis: the most important observations are deducted from the questionnaires and supporting materials. Although it is more qualitative in nature, we aspired to collect characteristics relevant in several settings, thus maximizing the cumulative effects of the interventions. Whenever it was relevant, we also paid separate attention to the different types of interventions. In the last sections we collected some of the best individual ideas found in the interventions. These can be inserted into future interventions under appropriate circumstances.



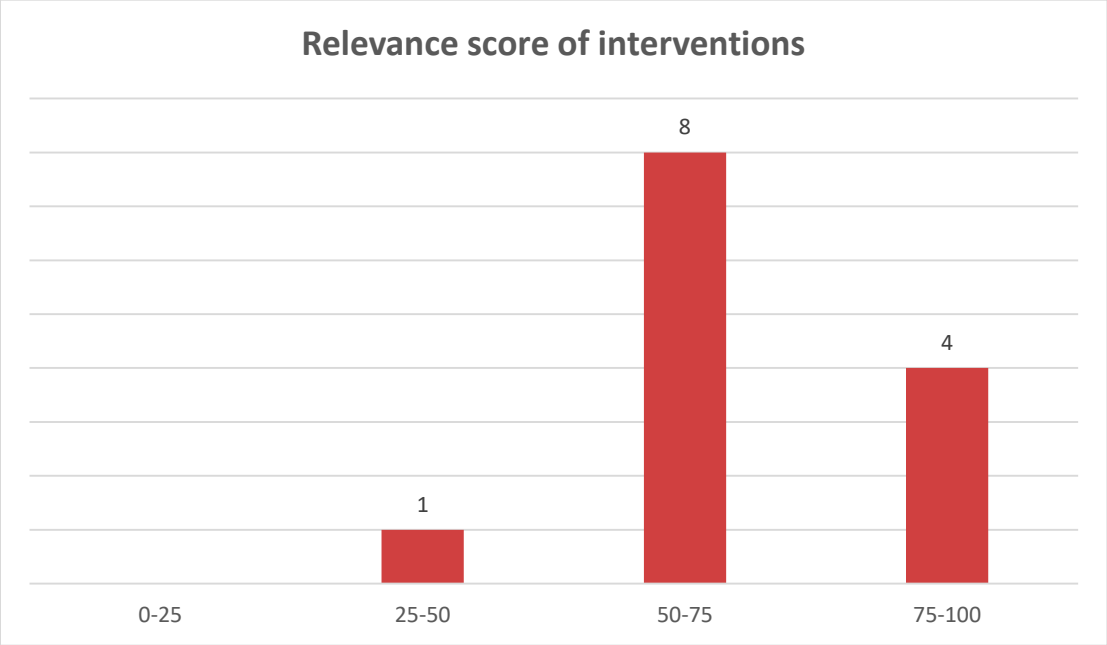
Relevance

An intervention is considered relevant when it is able to satisfy the identified needs of the stakeholders and is also valuable to the said groups. Relevance can also be interpreted across time and place; the closer it is to the present and the location of the study, the higher the relevance.

The relevance of the interventions was evaluated by questions inquiring about the potential of the intervention to serve the needs of different target groups and their consequent success in this respect. The place and time of the interventions were also taken into consideration during the calculation of the results. The answers were quantified with a maximum score of 100 available as in each of the indicator categories.

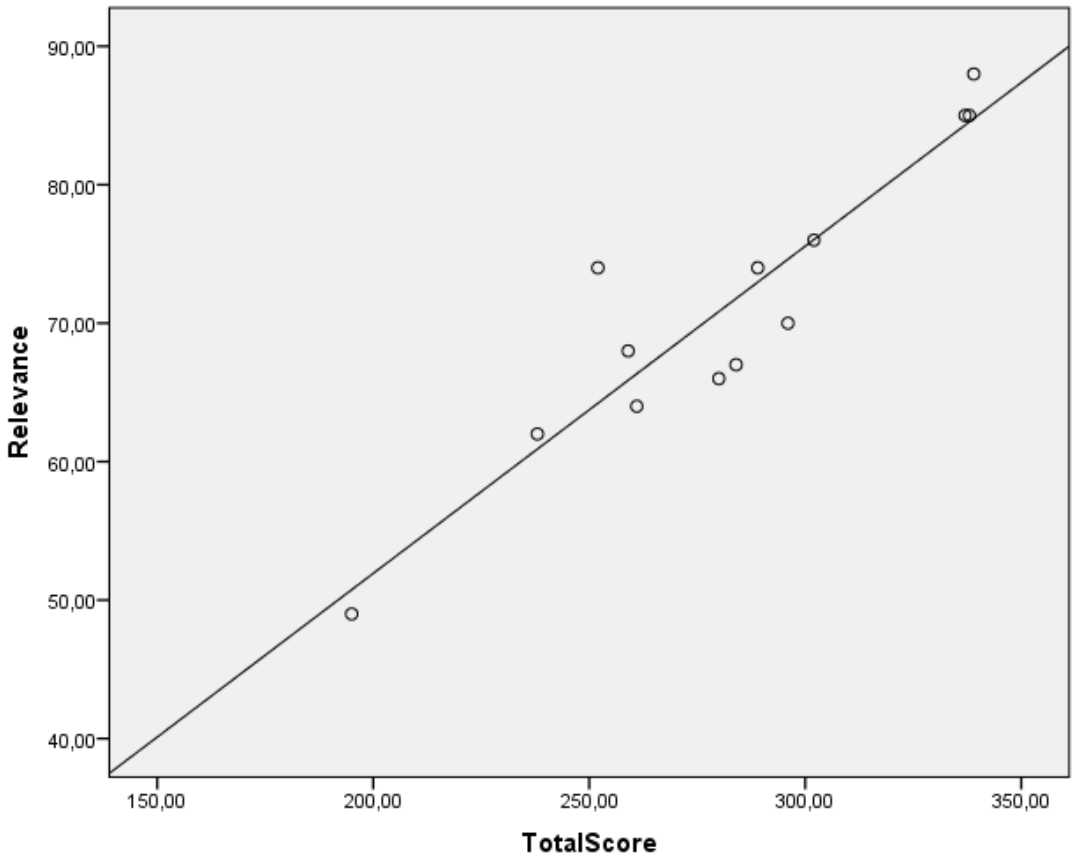
Scoring analysis

Overall, the analyzed interventions have scored very good on the relevance scale. Four of the examined interventions were over 75 points. Only one intervention was below 50 points (49 points to be exact).



The high scores are mainly due to the fact that the examined interventions were well planned and very recent since the 12 out of 13 have been published after 2016 (only one was published in 2011). Only three interventions were identified in the EU (plus one in UK). It is clear that many more European based interventions would be needed to create more robust evidence in support of exercise-based rehabilitation in post-stroke patients.

In regard to the relevance, the following indicator shows the highest correlation with the total score as demonstrated by the correlation coefficient of r=0.929 and the figure below.



One of the most important aspects of the relevance-analysis is measuring the value provided to the target groups. The answers to the following questions: 'How valuable is the intervention for patients?' and 'How valuable is the intervention for healthcare personnel?' have produced some valuable insights. This simple table shows the difference in average and standard deviation in the answers provided for these questions across the 13 interventions.

Question	Average	Standard deviation
How valuable is the intervention for patients?	3.80	0.72
How valuable is the intervention for healthcare personnel?	3.37	0.67

While it is not unexpected that the interventions serve patient needs better, resulting in a significantly higher average, the small difference in standard deviation also signifies that interventions are more polarized in relation to patients. Although intervention planners should not be blamed for a strong focus on patients, healthcare personnel are also very important stakeholders and have a strong impact on the results.

Descriptive analysis

Interventions with the highest relevance score

- Hydrotherapy vs. conventional land-based exercise for improving walking and balance after stroke: a randomized controlled trial
- Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial
- Effectiveness of Wii-based rehabilitation in stroke: a randomized controlled study
- Land-based and aquatic trunk exercise program improve trunk control, balance and activities of daily living ability in stroke: a randomized clinical trial

Common characteristics with regards to relevance

- Walking and balance are important functions to recover after stroke. Functional limitations frequently necessitate ongoing rehabilitation. Independent walking is one of the major objectives of stroke rehabilitation.

Relevant in the following interventions: 1. Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial; 2. Whole-Body Vibration Combined with Treadmill Training Improves Walking Performance in Post- Stroke Patients: A Randomized Controlled Trial; 3. Dual-Task Exercise Reduces Cognitive-Motor Interference in Walking and Falls After Stroke; 4. Hydrotherapy vs. conventional land-based exercise for improving walking and balance after stroke: a randomized controlled trial

- Trunk muscle weakness in stroke patients is related to poor balance and mobility-related functional activities. Strengthening the trunk muscles leads to improvement in activities of daily living, including trunk performance and balance.

Relevant in the following interventions: 1. Effect of Core Stability Training on Trunk Function, Standing Balance, and Mobility in Stroke Patients: A Randomized Controlled Trial; 2. Land-based and aquatic trunk exercise program improve trunk control, balance and activities of daily living ability in stroke: a randomized clinical trial

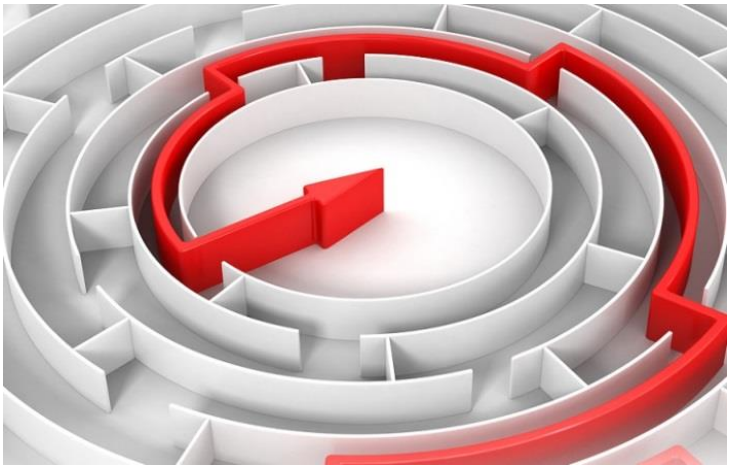
- Adequate postural control and good balance performance are prerequisites for independence in daily activities. As postural control is a prerequisite for most functional activities, weight shifting exercises aimed at improving postural control may have significant effects on balance during functional activities. Therefore, interventions that could alleviate balance impairments and improve balance and functional mobility should be important goals of long-term exercise-based.

Relevant in the following interventions: 1. Effects of Tai Chi Yunshou exercise on community-based stroke patients: a cluster randomized controlled trial; 2. Effectiveness of Wii-based rehabilitation in stroke: a randomized controlled study

Special examples relevant in practice

- Comparing early and late locomotor training in post-stroke patients with increased functional walking ability, there were similar improvements in walking speed, motor recovery, balance, functional status, and quality of life. Neither the delay in initiating the late locomotor training nor the severity of the initial impairment affected the outcome at 1 year. *(Body-Weight–Supported Treadmill Rehabilitation after Stroke).*

- Group activities provide social support and participation, which improves or preserves the quality of life. (*Effects of Tai Chi Yunshou exercise on community-based stroke patients: a cluster randomized controlled trial*).



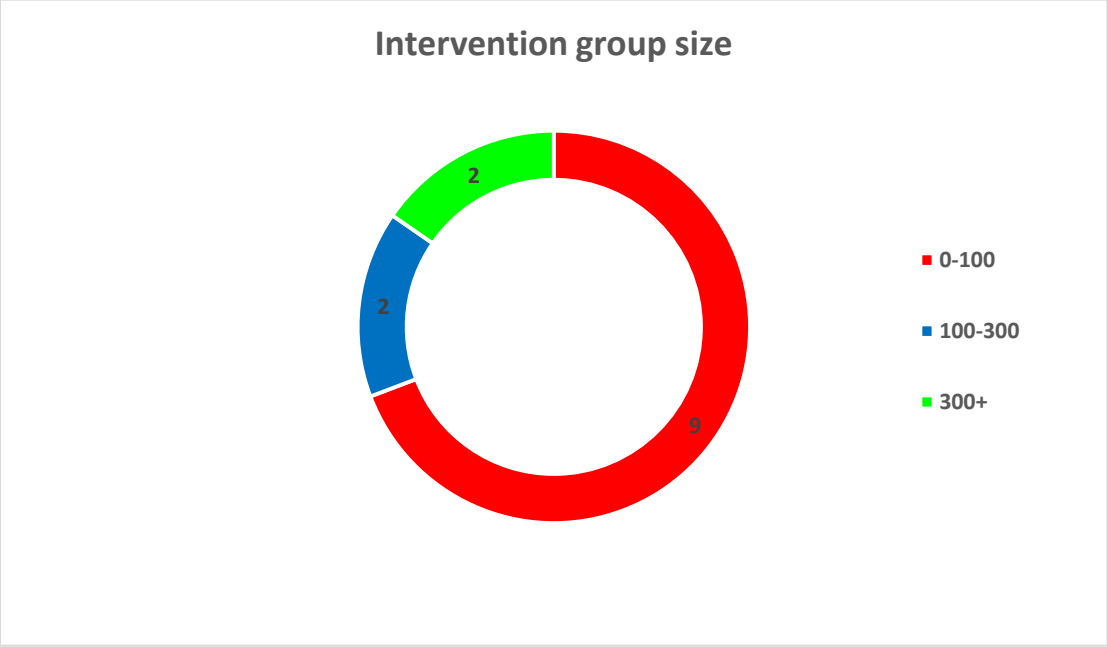
Quality

Quality is the ongoing process of building and sustaining relationships by assessing, anticipating, and fulfilling stated and implied needs. Quality is not a feature of an intervention, but an experience of the user.

The quality of the intervention can be evaluated objectively (by the size of the intervention and the control group, the gender mix, the number of assessment periods and the total length of the intervention), as well as subjectively (by the described experiences and observations from the participants). Perceived quality was measured by a direct question in the evaluation questionnaire and, more importantly, the described experiences and observations from participants in the interventions.

Scoring analysis

The quality of an intervention is greatly affected by the number of involved participants. In this respect the examined interventions perform rather poorly as demonstrated by the graph below.



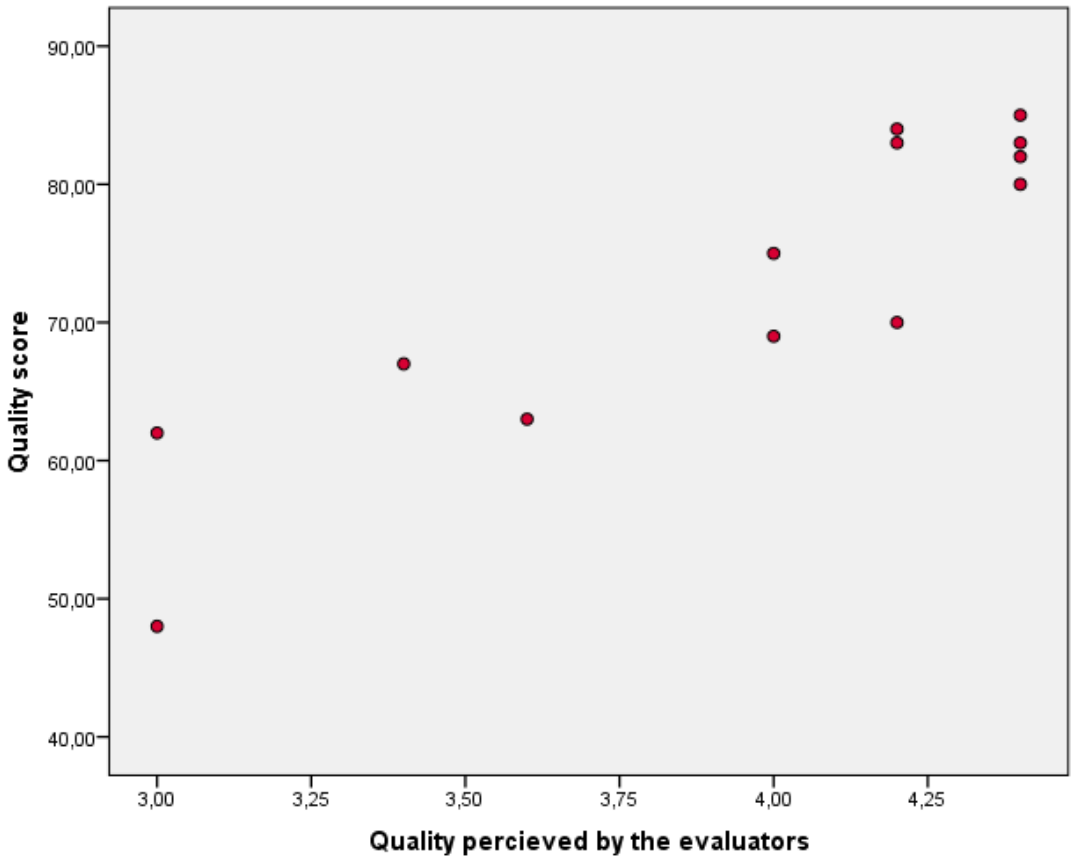
The number of participants was interpretable in all 13 interventions and this was below 100 in 9 cases (even below 50 in 6 interventions), only two interventions having more than 300 participants and precisely only one with more than 400 (408 to be exact). There are several reasons behind these low numbers:

1. The construct of the interventions: most (if not all) of these were studies financed from limited science budgets.
2. Patients should have been recruited from several institutions in order to involve several hundreds of them for a single study. This was not feasible in most cases.
3. While the experimenters obviously involved patients and doctors and were searching for answers to real life problems, the results were disseminated mainly towards the

scientific community and have not necessarily reached some other important stakeholders, i.e. decision makers.

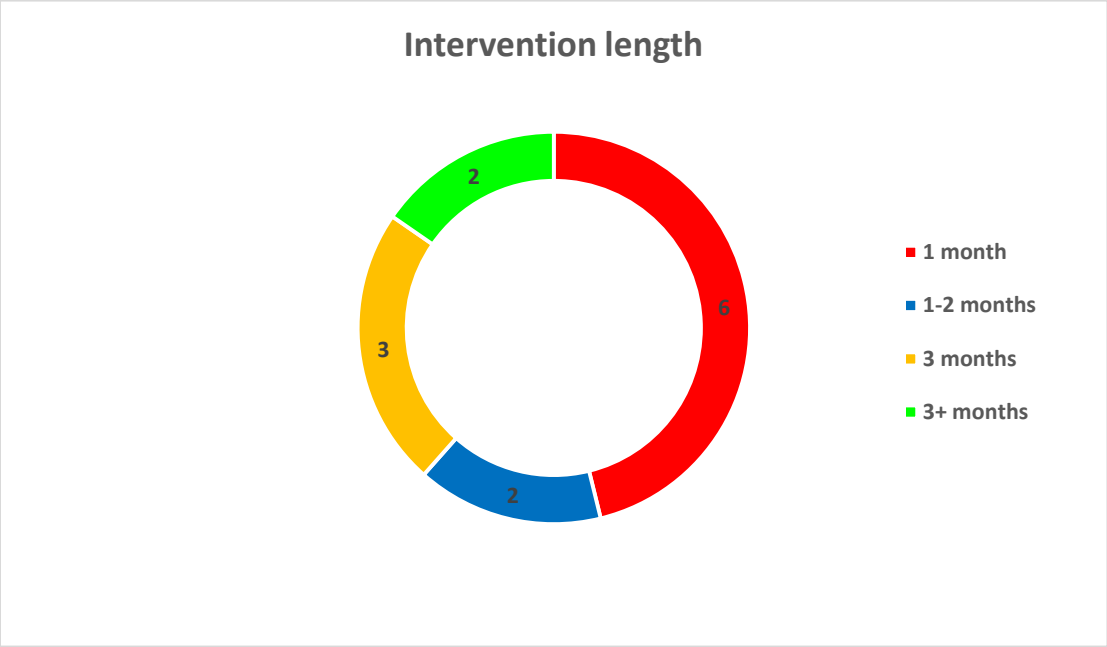
While these reasons are clear, they do not alter the fact that low participant numbers have a mitigating effect on the strength of the interventions. The small group of participants in the studies provides a weak base for statistical analysis, and again, even more importantly, they may not be enough to grab the attention of the real decision makers, who are in position to act on the results and implement changes in the structure of stroke exercise-based rehabilitation.

We wanted to know how the quality perceived by the evaluators of the interventions measures up with the overall quality score. The results are shown in the following graph.



The strong correlation efficient of r=0.896 confirms that perceived quality should not be considered different from measured quality. Indeed, there are not basically many differences in perceived quality compared to the overall relative score in each intervention.

Our project examines post-stroke long-term exercise-based programs and the below chart shows the total length of the interventions in months.



Only 5 out of the 13 studies spanned a time of at least three months and one of them only lasted for over a year (18 months to be exact). Apart from the difficulty of drawing meaningful conclusions from a short period, an important disadvantage was the studies' inability to assess outcomes using more practical functional tests reflecting the true abilities of daily living activities.

Furthermore, due to the time it takes for the exercise-induced physiological adaptations, a significant increase in functional capacity can only be detected months later.

Well supported evidence for the benefits of long -term post-stroke rehabilitation in general and physical exercise in particular, would make a much stronger case for the importance of exercise not only for patients but also doctors, other health professionals and stakeholders, many of whom are still skeptical and unconvinced. The message is clear: we should create long-term interventions to support the importance of physical exercise and lifelong rehabilitation in stroke patients.

Descriptive analysis

Interventions with the highest quality score

- Effectiveness of Wii-based rehabilitation in stroke: a randomized controlled study
- Hydrotherapy vs. conventional land-based exercise for improving walking and balance after stroke: a randomized controlled trial

- Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial
- Body-Weight–Supported Treadmill Rehabilitation after Stroke

Common characteristics with regards to quality

- A large number of patients after stroke do not participate in the interventions used in the studies. A lot of patients usually do not meet the inclusion criteria of each study, or decline participation. Participation rate in the clinical trials typically is not high and that is a major issue in all intervention studies. To prove the significance of this phenomenon, let us just quote a figure from one of the interventions where less than 4% of the screened adults with stroke were included in the trial. The low participation rate reduces the quality and the relevance of each intervention as well as the accuracy of the results: it has the potential to strongly distort statistical results by eliminating unmotivated and uninterested participants and thus inadequately modeling reality.

Relevant in almost all of the examined interventions.

- It is important to optimize the training protocols suitable for each patient. Early initiation and the application of long-term, specific and intensive exercise-based rehabilitation programs are recommended for more benefits.

Relevant in the following interventions: 1. Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial; 2. A physical activity intervention to prevent cognitive decline after stroke: secondary results from the life after stroke study, an 18-month randomized controlled trial; 3. Effects of aerobic training on physical activity in people with stroke: a randomized controlled trial

- There are many different factors that affect and influence the effects of each intervention in clinical practice. Assessment of each patient's functional limitation is of high significance. Measurement of spasticity, motor recovery, and patient participation are also important to identify exercise rehabilitation benefits. Moreover, there is a need to stratify for stroke severity before delivery of any intervention.

Relevant in the following interventions: 1. Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial; 2. Whole-Body Vibration Combined with Treadmill Training Improves Walking Performance in Post- Stroke Patients: A Randomized Controlled Trial; 3. Dual-Task Exercise Reduces Cognitive-Motor Interference in Walking and Falls After Stroke; 4. Hydrotherapy vs. conventional land-based exercise for improving walking and balance after stroke: a randomized controlled trial; 5. Unilateral Strength Training and Mirror Therapy in Patients With Chronic Stroke

- Common issues identified in many interventions is the small sample sizes, the lack of or short follow-up assessments and the limited types of stroke studied (usually mild-to-moderate). The introduction of many large-scale interventions is required.

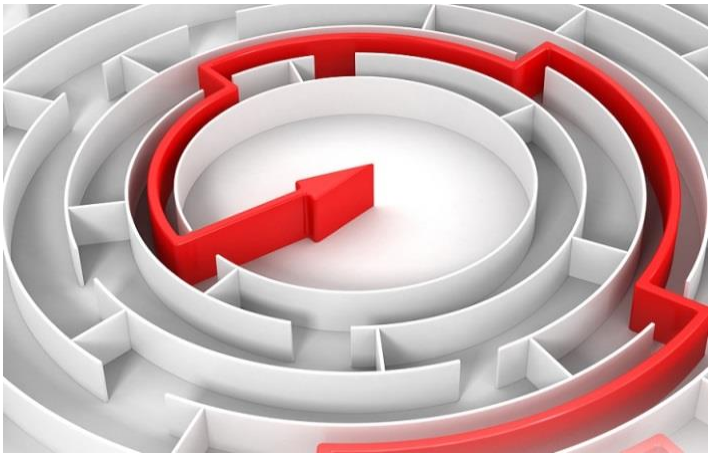
Relevant in more than half of the examined interventions.

Special examples relevant in practice

- Stroke rehabilitation often requires multiple behavior modifications. Health education provided to all individuals throughout the intervention period contributes to this direction. *(Effects of Tai Chi Yunshou exercise on community-based stroke patients: a cluster randomized controlled trial).*

- Low training frequency with high aerobic exercise intensity may be optimal for improved physical performance and quality of life in combination with a high adherence. The outcomes of the exercise rehabilitation programs in stroke patients persisted at 6-month follow-up, especially in patients with an interest in training. (*Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial*).

- The only intervention (regular coaching to perform 30 min physical activity daily every day and 45–60 min of physical exercise with 2–3 bouts of vigorous intensity levels every week) lasting 18 months had significantly increased adherence to the intervention associated with improved cognitive function that shorter interventions could not measure. Long interventions have the potential to alter perceptions of patients and medical professionals alike. *(A physical activity intervention to prevent cognitive decline after stroke: secondary results from the life after stroke study, an 18-month randomized controlled trial)*



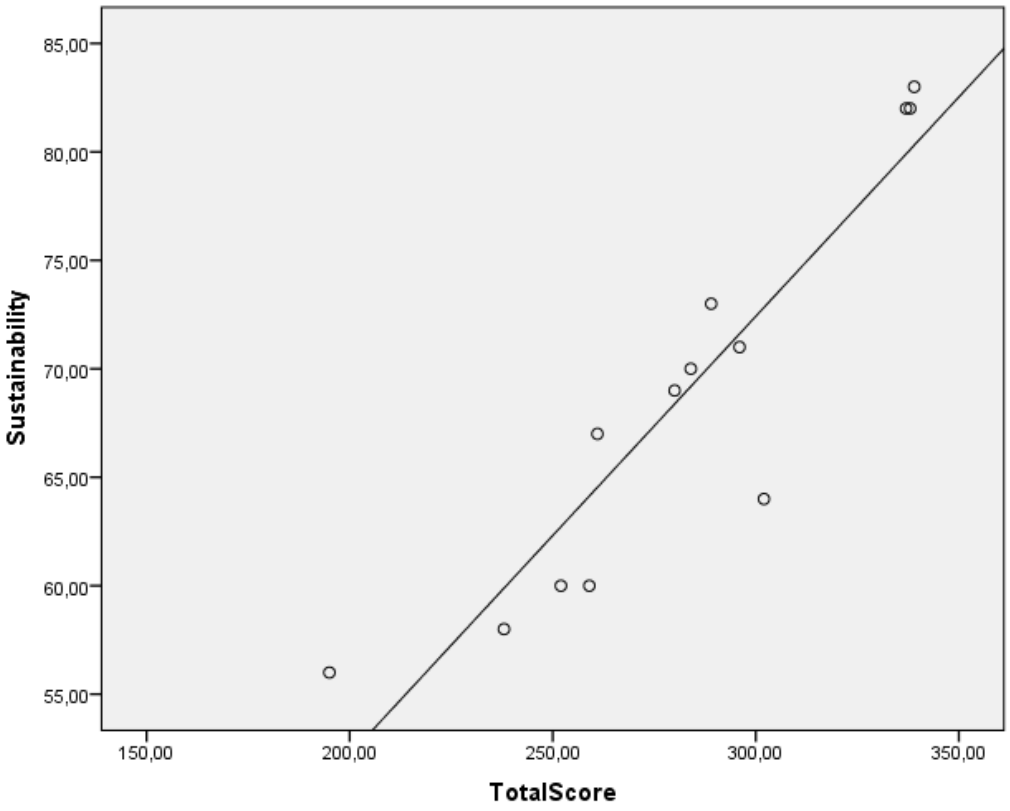
Sustainability

An important factor to be considered is whether the positive effects of an intervention outlast the project, providing future benefits even without further investment. Thus, sustainability refers to the general phenomenon of the continuation of an intervention or its effects. Attention to the long-term viability of health interventions is likely to increase as policy makers, practitioners and funders become increasingly concerned with allocating scarce resources effectively and efficiently.

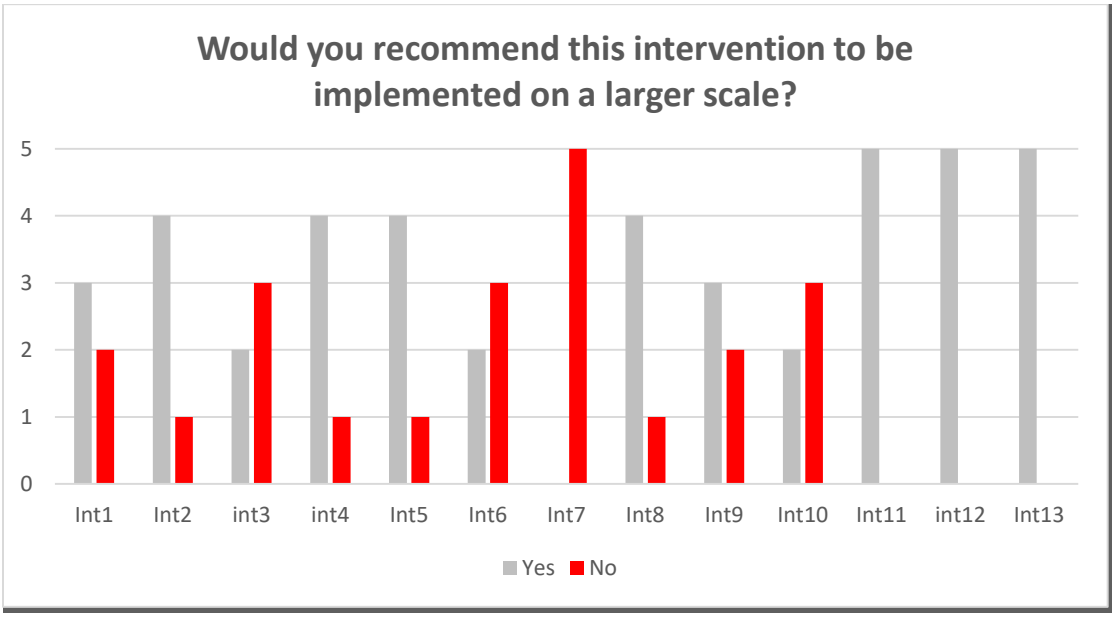
Sustainability was measured by a direct question in the evaluation questionnaire.. An important factor is whether the positive effects of an intervention outlast the project, providing future benefits even without further investment. Unfortunately, as the analyzed studies were trying to create controlled environments with limited desire for immediate practical application, sustainability was rarely considered as an important factor. It was possible nevertheless in many cases to draw very plausible conclusions based on the information provided and this chapter is certainly not without very relevant lessons.

Scoring analysis

Correlation analysis performed among the different variables revealed that sustainability has significant correlations with relevance, quality and effectiveness, (r=0.820, r=0.741, r=0.853, respectively) and a strong positive correlation efficient with the total score (r=0.920), the latter demonstrated in the following figure.



The question: 'Would you recommend this intervention to be implemented on a larger scale?' measured sustainability explicitly. An interesting finding was a relatively high disagreement of the different 5 evaluators with regards to the same interventions. The level of differences is demonstrated by the below graph, showing the positive and the negative evaluations between the scores for each of the 16 interventions. Three interventions showed only positive answers, while all evaluators replied negatively only in one intervention.



The results indicate that every country has its own stroke rehabilitation settings and it is difficult to implement new interventions in larger scale. A successful intervention in a particular setting does not guarantee similar results, in case that the stakeholders' perceptions are different.

Sustainability was also measured by analyzing answers to the following question: 'How much effort is required from the following groups?', the groups in question being (1) patients; (2) healthcare personnel. It is interesting to note that the average value across all interventions was almost the same for these two groups (3.95 and 3.20, respectively on a scale of 5). Evaluators clearly agree that the main stakeholders of stroke rehabilitation interventions are patients and healthcare professionals. We are not sure that this perception should really hold up in the future. If we want to achieve meaningful changes, rehabilitation should be given a much wider perspective across a variety of sectors and players.

Descriptive analysis

Interventions with the highest sustainability score

- Hydrotherapy vs. conventional land-based exercise for improving walking and balance after stroke: a randomized controlled trial
- Effectiveness of Wii-based rehabilitation in stroke: a randomized controlled study
- Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial
- Effect of Core Stability Training on Trunk Function, Standing Balance, and Mobility in Stroke Patients: A Randomized Controlled Trial

Common characteristics with regards to sustainability

- Treadmill based aerobic physical fitness training should be administered with caution early after moderate to severe stroke, since it was found to increase risk of falls during the treatment period and caused a higher number of acute hospital admissions and recurrent strokes.

Relevant in the following interventions: 1. Body-Weight–Supported Treadmill Rehabilitation after Stroke; 2. Physical Fitness Training in Patients with Subacute Stroke (PHYS-STROKE): multicentre, randomized controlled, endpoint blinded trial

- A series of measures, including simultaneous health education should be taken to ensure the adherence and safety of post-stroke patients participating in physical activity and exercise training programs. Tailored training programs, based on the patient's preferences and goals are also suggested.

Relevant in the following interventions: 1. Effects of Tai Chi Yunshou exercise on community-based stroke patients: a cluster randomized controlled trial; 2. A physical activity intervention to prevent cognitive decline after stroke: secondary results from the life after stroke study, an 18-month randomized controlled trial; 3. Body-Weight–Supported Treadmill Rehabilitation after Stroke

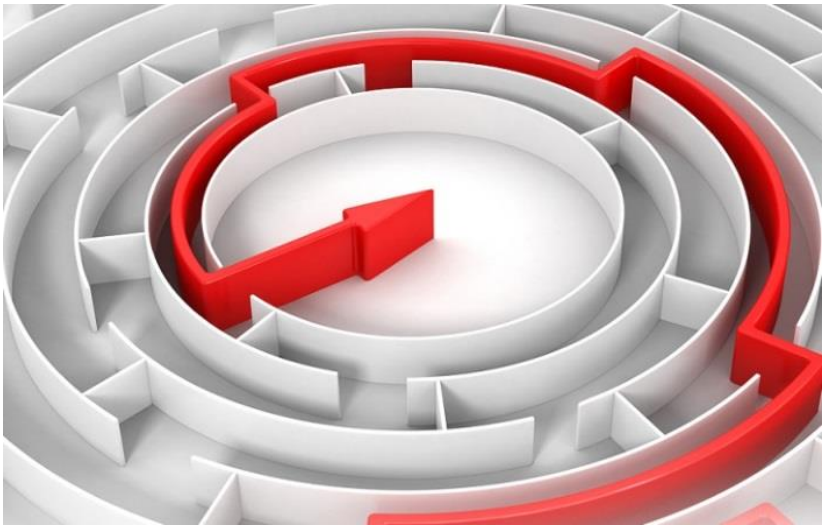
- People with stroke who are able to walk (but not people who are dependent in walking at start of treatment) appear to benefit most from treadmill training interventions with regard to walking speed and walking endurance. Participants who walk independently (functional ambulation category score >2) can improve their walking speed and walking endurance, whereas those who are not able to walk independently (score 0-2), do not seem to improve with treadmill training.

Relevant in the following interventions: 1. Body-Weight–Supported Treadmill Rehabilitation after Stroke; 2. Physical Fitness Training in Patients with Subacute Stroke (PHYS-STROKE): multicentre, randomized controlled, endpoint blinded trial; 3. Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial

Special examples relevant in practice

- A series of measures were carried out to ensure the adherence and safety of the participants: (1) Small class sizes (maximum of five/group), so that the intervener could provide on-site guidance and supervision sufficiently; (2) Community health centers near the subjects were selected as training venues to ensure compliance; (3) Those who could not exercise continuously could complete the session in sections; (4) Health education was provided; (5) Weekly telephone follow-ups and monthly family follow-ups were used to improve the return ratio; (6) Exercise is constructed as a group training, community-based program, in which individuals can receive encouragement including social support and knowledge acquisition. *(Effects of Tai Chi Yunshou exercise on community-based stroke patients: a cluster randomized controlled trial)*

- Physical activity may help keep the brain healthier and preserve cognitive ability and mood years after a stroke. Post-stroke participants in physical activity and exercise programs should be stratified into subgroups based on supposed reversibility, in order to prevent further cognitive decline. *(A physical activity intervention to prevent cognitive decline after stroke: secondary results from the life after stroke study, an 18-month randomized controlled trial)*



Effectiveness

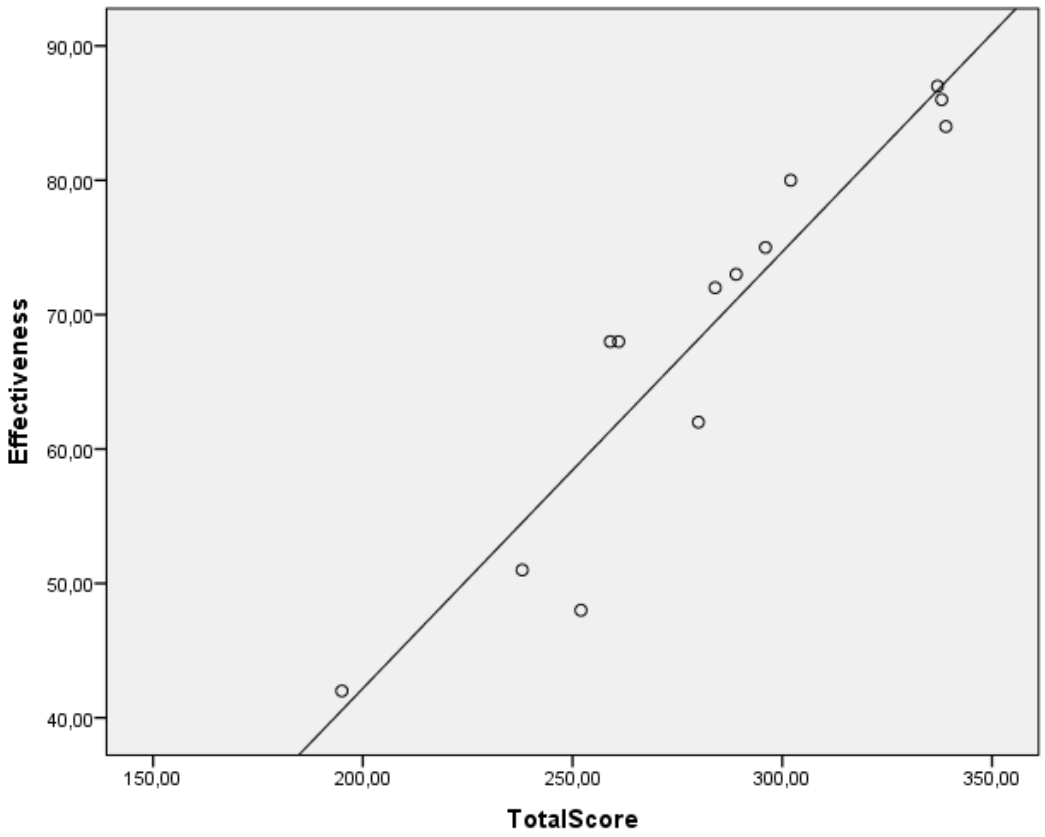
Effectiveness is the capability of producing a desired result. An intervention is considered effective when it has been evaluated and the final results show to have reached its target for specific indicators with a determined agreed tolerance. One important indicator of effectiveness is the number and seriousness of the limitations characterizing the studies. Most of the analyzed interventions identified some limitations in the original study texts. We have not only counted these limitations but their seriousness was also considered when calculating a score of effectiveness.

Apart from limitations, we also placed a direct question about the effectiveness of the intervention in the questionnaire.

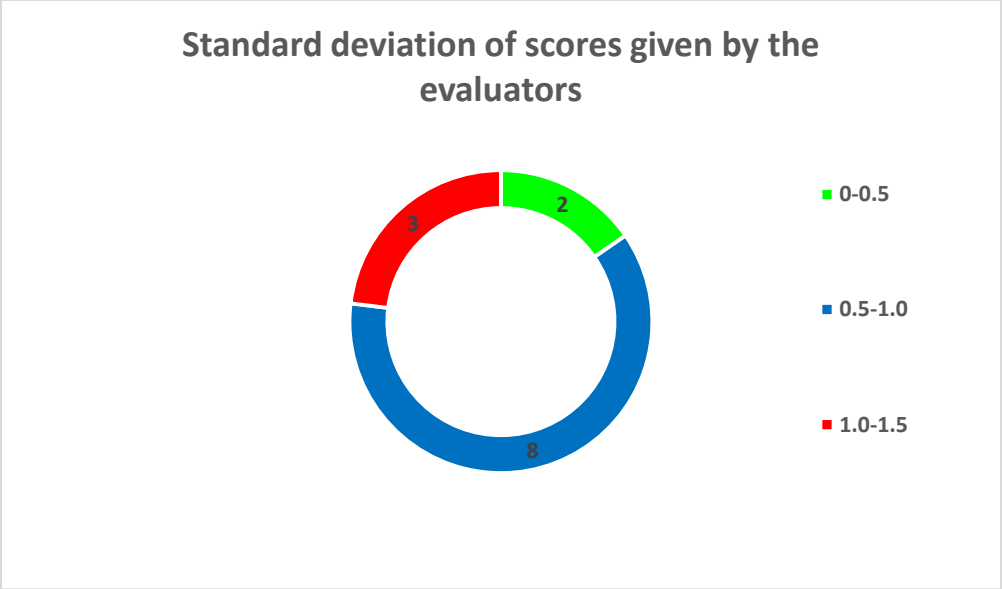
The final factor related to effectiveness was the complexity of outcome measures; deliberate application of well-defined outcome measures increased the effectiveness score of the interventions.

Scoring analysis

Between all correlated indicators with the total score of the examined interventions, effectiveness had the strongest coefficient (r=0.939), as demonstrated in the graph below.



We also examined the extent to what the evaluators from the different partner countries agreed on the effectiveness of the different interventions.



The results are different compared to what we got in the analysis of sustainability. Here project partners were in almost complete agreement in the case of two interventions and the opinions on the rest were also quite similar. This result proves that professional views of effectiveness are much more uniform than that of sustainability.

Descriptive analysis

Interventions with the highest effectiveness score

- Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial
- Effectiveness of Wii-based rehabilitation in stroke: a randomized controlled study
- Hydrotherapy vs. conventional land-based exercise for improving walking and balance after stroke: a randomized controlled trial
- Land-based and aquatic trunk exercise program improve trunk control, balance and activities of daily living ability in stroke: a randomized clinical trial

Common characteristics with regards to effectiveness

- Increased adherence to physical activity and exercise is associated with improved functional capacity and cognitive function, indicating that the intervention dose might be of importance to achieve a benefit. Exercise-based rehabilitation programs should include education regarding healthy lifestyle and focus on motivation to adhere to the physical program over time.

Relevant in the following interventions: 1. A physical activity intervention to prevent cognitive decline after stroke: secondary results from the life after stroke study, an 18-month randomized

controlled trial; 2. Effects of aerobic training on physical activity in people with stroke: a randomized controlled trial

- Recent years have seen growing interest in the use of new technologies in stroke rehabilitation. Clinical results indicate that the use of sensors or biofeedback may assess patients more precisely, while the use of VR technologies can represent a useful adjunctive therapy to traditional treatment to improve motor functioning, static and dynamic balance in stroke patients.

Relevant in the following interventions: 1. Whole-Body Vibration Combined with Treadmill Training Improves Walking Performance in Post- Stroke Patients: A Randomized Controlled Trial; 2. Effectiveness of Wii-based rehabilitation in stroke: a randomized controlled study

Special examples relevant in practice

- Light-to-moderate physical activity may represent a treatment strategy less likely to affect the underlying pathology in the chronic phase. However, it might halt or slow decline through building brain reserve and thereby delay symptom onset. A potential benefit on vascular pathology to prevent cognitive dysfunction, due to chronic cerebral hypoperfusion, may need longer follow-up. Physical activity could have a beneficial effect on cognitive flexibility and brain reserve, but an effect through neurogenesis and angiogenesis may be achieved through interventions with higher intensities. *(A physical activity intervention to prevent cognitive decline after stroke: secondary results from the life after stroke study, an 18-month randomized controlled trial)*

- An aerobic physical fitness training intervention with bodyweight support cannot be generally endorsed in adults after subacute stroke and should be administered with caution when applied early after moderate or severe stroke. Careers should closely monitor people with stroke for recurrent cardiovascular events and provide additional support after training to prevent falls. (*Physical Fitness Training in Patients with Subacute Stroke (PHYS-STROKE): multicentre, randomized controlled, endpoint blinded trial*)

- Even a relative short hydrotherapy program of 4 weeks should be considered as an effective tool for improving postural balance and mobility in chronic stroke patients. *(Hydrotherapy vs. conventional land-based exercise for improving walking and balance after stroke: a randomized controlled trial)*

    - Wii Fit-based balance rehabilitation could represent a useful adjunctive therapy to traditional treatment to improve static and dynamic balance, functional motor ability, and independence in subacute and chronic stroke patients. Although, the positive effects of virtual rehabilitation continue 4 weeks after termination of the treatment, a more intense and longer application of Wii Fit and a longer follow-up period following the completion of the exercise program could increase the effectiveness of the rehabilitation. *(Effectiveness of Wii-based rehabilitation in stroke: a randomized controlled study)*

Vertical evaluation

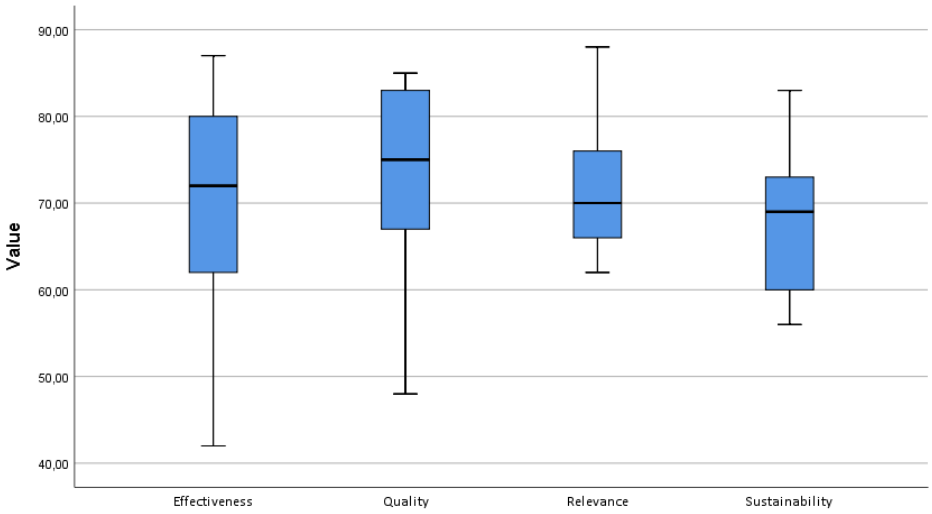
At the vertical evaluation, we tried to form an objective ranking based on the scoring system. In the indicator analysis chapter above, we highlighted the strengths, weaknesses and unique features of the interventions torn down to indicators. Hereby we attempt to unite those and identify 'gold standard' initiations that might be most feasible in a European context. The overall score of the interventions is calculated as the sum of the indicator scores. Below is a list of all the interventions with their summarized scores:

Intervention	**Total score**
Hydrotherapy vs. Conventional Land-based Exercise for Improving Walking and Balance after Stroke: A Randomized Controlled Trial	339,00
Effectiveness of Wii-based Rehabilitation in Stroke: A Randomized Controlled Study	338,00
Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial	337,00
Land-based and Aquatic Trunk Exercise Program Improve Trunk Control, Balance and Activities of Daily Living Ability in Stroke: A Randomized Clinical Trial	302,00
Effects of Tai Chi Yunshou Exercise on Community-based Stroke Patients: A Cluster Randomized Controlled Trial	296,00
Effect of Core Stability Training on Trunk Function, Standing Balance, and Mobility in Stroke Patients:A Randomized Controlled	289,00
Dual-Task Exercise Reduces Cognitive-Motor Interference in Walking and Falls After Stroke	284,00
Body-Weight–Supported Treadmill Rehabilitation after Stroke	280,00
Effects of Aerobic Training on Physical Activity in People with Stroke: A Randomized Controlled Trial	261,00
Whole-Body Vibration Combined with Treadmill Training Improves Walking Performance in Post- Stroke Patients: A Randomized Controlled Trial	259,00
Physical Fitness Training in Patients with Subacute Stroke Physical Fitness Training in Patients with Subacute Stroke (PHYS-STROKE): multicentre, randomized controlled, endpoint blinded trial	252,00
A Physical Activity Intervention to Prevent Cognitive Decline after Stroke: Secondary Results from the Life After Stroke Study, an 18-Month Randomized Controlled Trial	238,00
Unilateral Strength Training and Mirror Therapy in Patients With	195,00

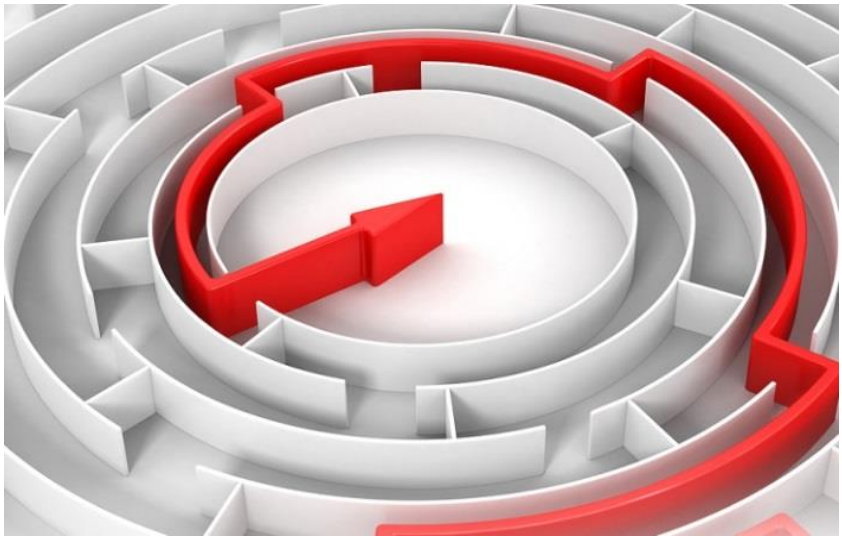
The above rating might be distorted because of possible outlier values. To balance these possible biases, we calculated a mean deviation of the five indicators at each of the initiations.

All interventions fall between 40% and 90% overall. As it is clear from the above analysis, many interventions are a healthy mix of good practices and somewhat unrealistic expectations, with plenty of lessons to be learned and used to plan and execute better programs in the future. Within the 13 interventions, 5 were unbalanced with 20-30 points of difference among their indicators according to our scoring analysis.

We have also prepared a box plot about the indicator-specific distribution of the interventions.



As you can see from this figure, effectiveness scores showed the largest dispersion of all indicator categories. Average relevance and sustainability scores were markedly lower compared to effectiveness and quality scores.



Analysis of partner countries interventions

We have collected two stroke long-term rehabilitation related interventions from each partner (for details of the interventions, see Appendix 4). There were no preconditions attached to these interventions and consequently they are very much varied. Most of the interventions received were scientific studies (similar to the ones analyzed in Chapter 4), while others were practical and concrete actions. The following table contains the titles, the origin countries and the type of the received interventions.

Intervention title	**Country**	**Type**
Stationary vs home rehabilitation	Croatia	Study
Rehabilitation with mirror-induced visual illusion	Croatia	Study
Robotic rehabilitation	Czech Republic	Study
Amadeo instrument in chronic rehabilitation	Czech Republic	Study
Cervical isometric exercises	Greece	Study
Exercise rehabilitation program with experiential music	Greece	Study
Adaptive physical activity with therapeutic patient education	Italy	Study
Low-intensity endurance and resistance training	Italy	Study
Virtual reality and traditional physiotherapy	Lithuania	Action
Gait training with KinisiForo System	Lithuania	Action

For analysis purposes a scoring system was created, based on the objective facts provided in the descriptions. While directly comparing different kinds of interventions poses difficulties, criteria were chosen, that can be universally applied regardless of the intervention type. The aim was not the rigorous analysis of all intervention aspects, but rather the creation of a tool able to identify good examples present in the descriptions. Instead of an elaborate scoring mechanism, we only applied a basic system with a minimum score of 1 and maximum score of 3. The following table contains the definitions of the examined factors and the corresponding values. A total score was calculated by summing all the individual scores.

Score	Description	Score of 1	Score of 2	Score of 3
Setting	How far is the intervention removed from a hospital setting?	Hospital setting only	Other healthcare setting	Non healthcare setting
Group size	Number of intervention participants*	Low <30	Medium 30-100	Large >100
Outreach	The number of stakeholder groups involved	Only patients and stroke related healthcare personnel	Patients and a variety of healthcare personnel	Patients, healthcare personnel and other groups
Timeframe	Relative length of the intervention*	Short < 3 months	Medium 3-6 months	Long >6 months
Early phase / late phase	How far is the intervention removed from the stroke event?	Within three months	Within six months	Longer
Measurement	To what extend have the results of the intervention measured across time, place and other groups?	Minimal or non-existent measurement	Some meaningful measurement	Well planned and comprehensive measurement
Exercise/physical activity centered	To what extend is exercise/physical activity (the topic of the My WAY project) included in the intervention?	Not included	Exercise/physical activity is part of the intervention	The intervention's main focus is exercise/physical activity
Advanced methods	How much does the intervention utilize novel technologies or special devices or exercise machines and sophisticated tools and methodologies?	Traditional ways only	Some new elements	Pioneering new, advanced tools and/or methods

**Score depends on the type of intervention. A scientific study is usually limited in participant numbers and there is also a stricter time constrain. Similarly, a local initiative targets (and reaches) less people compared to a regional or national one.*

In the following part of this chapter this scoring system will be used to examine these interventions in comparison of each country's local context (WP3 Report) to provide a short analysis for every partner country. It is important to note that the given scores relate only to the processed interventions and they in no way represent the state and development level of a country's stroke rehabilitation system. The aim of the analysis was to highlight the interesting and forward looking elements of each intervention and pinpoint the lessons that can be learned from them.

CROATIA

In Croatia, once the stroke survivor is released from the hospital, the stroke survivor and their primary caregiver are given very little, if any, information regarding post hospital recovery procedures and rehabilitation options. The information given is most often very superficial and lacks a realistic picture of what awaits the stroke survivor in the immediate and distant future. The need for some form of standardized criteria regarding rehabilitation is thoroughly needed so that the stroke survivor may successfully reach the recovery from the burden of stroke. To achieve these goals a firm foundation must be put in place in which an alliance of all parties involved in the stroke survivors' rehabilitation and recovery can come together in order to maximize a successful post stroke outcome. Without complete collaboration and cooperation (within all branches of health care, social services, patient advocate groups, and the stroke survivors' primary caregiver) no true recovery from the burden of stroke can fully be achieved.

Although Croatia does not have a national rehabilitation program, there are national stroke rehabilitation guidelines available in the country. Nevertheless, in the stroke rehabilitation field there is a lack of a long-term rehabilitation plan, non-comprehensive rehabilitation, and recommendations about long-term physical activity.

The following table shows the scores given for the two Croatian interventions.

Title	Stationary vs home rehabilitation	Rehabilitation with mirror-induced visual illusion
Type	study	study
Setting	2	1
Group size	2	2
Outreach	2	1
Timeframe	1	1
Early phase / late phase	2	2
Measurement	3	2
Physical activity	3	2

Advanced	2	1
Total score	**17**	**12**

The two Croatian interventions use individualized approaches to minimize barriers and side-effects and to increase patients' motivation. The first Croatian intervention (Stationary vs home rehabilitation) compared the effects of inpatient stationary rehabilitation with rehabilitation at home on functional improvement of stroke patients (function of the upper limbs, lower limbs and balance). Taking in account all the results, the study showed that an individual approach to every stroke patient, with the evaluation of risk factors, comorbidities, socioeconomic situation, age and gender, would enable the most appropriate rehabilitation modality with the best cost-effectiveness.
The second Croatian intervention (Rehabilitation with mirror-induced visual illusion) aimed to assess the effect of mirror therapy for the improvement of arm dexterity, compared to standard rehabilitation modalities. This study showed the efficacy of mirror therapy in the improvement of motor function in the upper limb in post-stroke patients, leading to a greater potential of self-care and activities of daily living.

CZECH REPUBLIC

In Czech Republic, the rehabilitation process includes the stroke units, outpatient rehabilitation and specialized centers. Follow-up treatment is provided optimally in the patient's home environment, with outpatient care by a practitioner, specialists, non-medical health professionals and social institutions. Czech organization for rehabilitation of stroke victims emphasizes that the need for more physical, sport and creative activities is the issue that needs special attention. The people affected by stroke can produce these activities partly on their own, but they need necessarily organizational as well as logistic support. The organization for rehabilitation of stroke victims provides counseling and courses, and activates clubs throughout the country, but its reach is by far insufficient. It is highlighted that patient organizations should be more proactive in sharing knowledge and encouraging people in these activities.

The following table shows the scores given for the two Czech interventions.

Title	Robotic rehabilitation	Amadeo instrument in chronic rehabilitation
Type	study	study
Setting	1	1
Group size	2	1
Outreach	2	2
Timeframe	1	1
Early phase / late	3	3

phase		
Measurement	2	1
Physical activity	2	2
Advanced	3	3
Total score	**16**	**14**

The two Czech studies concern the use of novel robotic techniques to improve outcomes and patients' motivation. The robotic rehabilitation study aimed to verify the effects of robotic therapy in chronic stroke patients with spastic hand paresis in a degree according to modified Ashworth scale. It was concluded that the robotic rehabilitation has an important influence in antispastic treatment of fingers with perspective therapeutic results. Robotic technologies, providing optimal repeated rehabilitation stretching of spastic muscles can be used as supplement or substitution of the stretching techniques.

The second robotic Czech study (Amadeo instrument in chronic rehabilitation) aimed to prove sustainable improved functions after a month of intensive treatment on the Amadeo instrument and even a month after the therapy ended. The use of novel robotic techniques developed over the last decade provides the perspective of improving results of rehabilitation, as they proved useful for increasing the motor activity output. Nevertheless, any demonstrable influence on improvement of the fingers' motion range, muscular strength of fingers and hand functionality was not proved. However, the robotic assisted hand treatment of patients in the chronic phase after brain vascular event is evaluated very positively by the patients.

GREECE

In Greece, rehabilitation centers and voluntary organizations support local patients and their families after stroke.

Greece does not have a national rehabilitation program and patients' associations are not involved in stroke rehabilitation. In addition, there are no national stroke rehabilitation guidelines.

Hellenic Alliance/Action for Stroke aims to make an effort both to inform and educate the public about the treatment of a stroke and the health policy makers in order to achieve improvement of health services for the rehabilitation of the patient with stroke at the national level. Communication and cooperation between the scientists and the stroke survivors, is emphasized in order to update and exchange views, knowledge and experience which is the best possible way to treat, restore and help improve or maintain the functional capacity and quality of life of the stroke survivor.

The following table shows the scores given for the two Greek interventions.

Title	Cervical isometric exercises	Exercise rehabilitation program with experiential music
Type	study	study
Setting	1	1
Group size	2	1
Outreach	2	3
Timeframe	2	2
Early phase / late phase	2	1
Measurement	2	2
Physical activity	2	3
Advanced	1	1
Total score	**14**	**14**

The two Greek studies aimed to detect the effectiveness of different modalities of interventions, in order to improve the quality of rehabilitation interventions. The Greek study “Cervical isometric exercises” evaluated the use of cervical isometric exercises in dysphagic adult patients with cervical spine alignment disorders due to hemiparesis after stroke. Their use in hemiparetic stroke patients with dysphagic symptoms was shown to be beneficial in helping patients improve their cervical spine alignment and overcome deglutition disorders.
The second Greek study focused on the application of experiential music in an exercise post-stroke rehabilitation program. It seems that the music-based exercise programs have a positive effect on mood profile in stroke patients and recovery rate is higher when exercise rehabilitation program is accompanied by an enriched sound environment with experiential music. Moreover, to improve the quality of rehabilitation interventions, it is important to predict the prognosis for stroke.

ITALY

In Italy, 80% of patients are prescribed to continue rehabilitation after the discharge from the hospital. The rehabilitation may take place in the hospitals, out of hospital, or in the training facilities. Rehabilitative long-term care is provided in rehabilitative day-hospital, physiotherapy structures, and at home.

The following table shows the scores given for the two Italian interventions.

Title	Adaptive physical activity with therapeutic patient education	Low-intensity endurance and resistance training
Type	study	study
Setting	2	2
Group size	3	2
Outreach	2	3
Timeframe	1	1
Early phase / late phase	3	3
Measurement	2	2
Physical activity	3	3
Advanced	1	1
Total score	**17**	**17**

The first Italian study evaluated the effectiveness, in both the short and long period of therapeutic patient education and adapted physical activity intervention in stroke survivors. It has been observed a significant improvement on mobility, balance and on patients' perception of recovery from the acute phase. The increased number of participants showed the value of a large sample in rehabilitation studies; moreover, the contribution of a long-term follow-up (12 months) showed the importance to verify the intervention long-term effects. Overall, adapted physical activities associated to therapeutic patient education is a useful and potentially cost-effective intervention to maintain and improve activities of daily living, reduce fractures and recourse to rehabilitation treatments.

The "low intensity endurance and resistance training" study addresses the crucial issue of intensity that the rehabilitations programs of stroke patients should have. It was shown that an 8-week, community-based, progressive mixed endurance-resistance exercise program at lower cardiovascular and muscular load leads to better mobility benefits than a higher-intensity program in chronic stroke survivors.

It seems that the main factors that positively influence the sustainability and transferability of those interventions are the cooperation between specialist doctors, dedicated professionals, and patients, as well as training of specialized professionals in this field, presence of adequate structures and cooperation between different healthcare centres. The main aspects that negatively affect sustainability and transferability are the potential difficulty, among different regions, to obtain funds in the public healthcare system to guarantee an adequate delivery of the program, the lack of a structured and organized regional healthcare network and the reduced advertising promotion of relevant projects.

LITHUANIA

Lithuania has a national rehabilitation program. After the discharge, the rehabilitation take place in hospitals, training facilities, rehabilitation hospitals and rehabilitation centres. About 10% of all patients take part in rehabilitation programs as outpatients and 90% as inpatients. There are national stroke rehabilitation guidelines available, and patients' associations are involved in stroke rehabilitation process.

The following table shows the scores given for the two Lithuanian interventions.

Title	Virtual reality and traditional physiotherapy	Gait training with KinisiForo System
Type	action	action
Setting	1	1
Group size	1	1
Outreach	2	2
Timeframe	1	1
Early phase / late phase	1	2
Measurement	1	1
Physical activity	1	3
Advanced	3	3
Total score	**11**	**14**

The two Lithuanian interventions were both offered in the Palanga Rehabilitation Hospital and used novel techniques to enhance motivation of the patients. The "Virtual reality and traditional physiotherapy" Lithuanian study revealed that the application of a PC virtual reality system enhanced rehabilitation in stroke patients. Specifically, it was shown that patients who spent the most time on virtual reality therapy procedures during their departure from the rehabilitation center significantly improved their independence. In order to maintain such motivation for a longer period, it is recommended to train continuously and expand the computer package with

new programs. Overall, virtual reality seems to be a useful way to involve patients in the rehabilitation process.

The second Lithuanian study (Gait training with KinisiForo System) addressed the effects of different physiotherapy techniques on gait recovery in patients after stroke comparing KinisiForo System with the traditional over ground gait training exercises. This intervention showed that after gait training with novel exercise technologies, patients experience bigger improvement in gait. End-effector type robot-assisted gait training systems strongly influenced changes in propulsion generation during gate cycle. The principle of elliptical motion ensures better trunk control and influences change in gait symmetry. The above-mentioned factors strongly influence change in walking speed and conclusively, sophisticated exercise machines can indeed substantially improve the rehabilitation outcomes of stroke survivors.

General analysis of interventions from MY WAY countries

The main characteristics of the strategies to increase participation in exercise-based stroke rehabilitation activities and improve the efficiency of a comprehensive long-term post-stroke rehabilitation system are summarized in the following table:

Action type	**Usage**
Education / data collection about CR benefits	There are still many patients (and even healthcare professionals) who are not totally convinced about the benefits of a long-term stroke rehabilitation program. Before trying to improve participation rates, there must be a consensus between the necessity and importance of long-term stroke rehabilitation. Promotional studies are essential.
Identify ways to overcome barriers through own studies or literature review	Scientific studies are needed to identify ways to overcome the main causes of non-participation. Most of the identified issues are still existing and valid. Countries with more developed stroke rehabilitation system need to focus on the involvement of the hard to reach populations and therefore design specialized studies.
Test new methodologies to overcome barriers	Mitigation of the barriers is also necessary. Similarly to the previous step, this action usually takes the form of some kind of controlled trial. The number of studies involving large patient cohorts and a long timeframe is still extremely limited (as evidenced by the interventions analyzed in Chapter 4).
Identify exercise training variables	MY WAY project's golden rules need to identify the main training variables (intensity, frequency, duration, type of exercise) that could lead to efficient exercise-based stroke rehabilitation. Countries with more developed stroke rehabilitation system need to aim the implementation of safe and effective exercise training programs and therefore

	design specialized studies.
Implement methodologies to increase participation	The lack of evidence in support of new technologies means that very few ideas have been implemented on a large scale, and consequently, long-term stroke rehabilitation participation rates have not improved significantly. Increasing participation need not necessarily rest on the evidence of rigorous controlled trials. Many centers/countries are using more of the traditional methods to achieve better results.

We have categorized all the interventions collected by partners according to these action types. While there can be overlapping among these action types and therefore some of the collected interventions arguably touch more than one of these categories, we felt that this classification is still justified and appropriate to prove our point.

Action type	**Intervention title**
Education / data collection about stroke rehabilitation benefits	1. Stationary vs home rehabilitation / Croatia 2. Cervical isometric exercises / Greece 3. Adaptive physical activity with therapeutic patient education / Italy 4. Low-intensity endurance and resistance training / Italy
Test new methodologies to overcome barriers	1. Rehabilitation with mirror-induced visual illusion / Croatia 2. Robotic rehabilitation / Czech Republic 3. Amadeo instrument in chronic rehabilitation / Czech Republic 4. Gait training with KinisiForo System / Lithuania
Implement methodologies to increase participation	1. Exercise rehabilitation program with experiential music / Greece 2. Virtual reality and traditional physiotherapy / Lithuania

While there is some correlation between the maturity of long-term stroke rehabilitation practice in a country and the type of action collected from project partners, it is merely an indication. For example the fact that both Italian interventions fall into the ‘Education / data collection about stroke rehabilitation benefits’ category does not mean that Italy is in the education / data collecting phase and has not started testing of new methodologies to overcome barriers and the implementation of new initiatives to increase participation rates. The clear objective for each country would be to systematically make the necessary steps to enhance overall exercise-based stroke rehabilitation attendance in the long term.

Conclusions

As we mentioned in the introductory part of our analysis, MY WAY project aims to contribute to long-term stroke rehabilitation promotion. Particularly, this project has the aim to develop, implement and transfer innovative practices related to physical activity enhancing health in post-stroke patients. One main goal of the project consortium is to identify interventions that could be effective once introduced in real life, first in the partner countries. An important part of this strategy is to reveal current situation and to identify proved good practices and strategies to increase the efficiency of stroke rehabilitation practices.

The following table is a summary of the most important findings of WP4. The listed recommendations can provide assistance in planning and managing an intervention aimed at introducing new or improved long-term stroke rehabilitation practices.

Recommendations	**Sources**
The use of novel techniques and VR methods provides the perspective of improving results of stroke rehabilitation, as they proved useful for increasing the motor activity output. **Example**: The application of virtual reality method was an efficient method for rehabilitation even of the patients who had a low level of self-support functions disorder.	1. Robotic rehabilitation / Czech Republic 2. Amadeo instrument in chronic rehabilitation / Czech Republic 3. Virtual reality and traditional physiotherapy / Lithuania 4. Gait training with KinisiForo System / Lithuania 5. Whole-Body Vibration Combined with Treadmill Training Improves Walking Performance in Post-Stroke Patients: A Randomized Controlled Trial 6. Effectiveness of Wii-based rehabilitation in stroke: a randomized controlled study
Patient education is important to ensure adherence and effectiveness of the rehabilitation program. Tailored training programs, based on the patient's preferences and goals are suggested. **Example**: Adaptive physical activity associated to therapeutic patient education results to be a useful intervention to maintain and improve mobility, balance, activities of daily	1. Adaptive physical activity with therapeutic patient education / Italy 2. Stationary vs home rehabilitation / Croatia 3. Effects of Tai Chi Yunshou exercise on community-based stroke patients: a cluster randomized controlled trial 4. A physical activity intervention to prevent cognitive decline after stroke: secondary results from the

living and quality of life.	life after stroke study, an 18-month randomized controlled trial 5. Body-Weight–Supported Treadmill Rehabilitation after Stroke
Long-term exercise-based rehabilitation is a complex process requiring a multidisciplinary approach for obtaining maximum independence and maximum possible self-reliance. The cooperation between specialized professionals and different healthcare centres and the presence of adequate structures are deemed necessary.	1. Amadeo instrument in chronic rehabilitation / Czech Republic 2. Stationary vs home rehabilitation / Croatia 3. Cervical isometric exercises / Greece 4. Robotic rehabilitation / Czech Republic 5. Adaptive physical activity with therapeutic patient education / Italy 6. A physical activity intervention to prevent cognitive decline after stroke: secondary results from the life after stroke study, an 18-month randomized controlled trial
To improve the quality of long-term exercise-based interventions, it is important to predict the prognosis for stroke and to stratify for stroke severity before delivery of any intervention. There are many different factors that affect and influence the effects of each intervention in clinical practice.	1. Exercise rehabilitation program with experiential music / Greece 2. Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial 3. Whole-Body Vibration Combined with Treadmill Training Improves Walking Performance in Post-Stroke Patients: A Randomized Controlled Trial 4. Dual-Task Exercise Reduces Cognitive-Motor Interference in Walking and Falls After Stroke 5. Hydrotherapy vs. conventional land-based exercise for improving walking and balance after stroke: a randomized controlled trial 6. Unilateral Strength Training and Mirror Therapy in Patients With Chronic Stroke
Rehabilitation interventions should be	1. Rehabilitation with mirror-induced

safe, cost-effective, easy to implement and using evidence-based methods and easily transfered equipment.	visual illusion / Croatia 2. Robotic rehabilitation / Czech Republic 3. Amadeo instrument in chronic rehabilitation / Czech Republic 4. Effects of Tai Chi Yunshou exercise on community-based stroke patients: a cluster randomized controlled trial 5. A physical activity intervention to prevent cognitive decline after stroke: secondary results from the life after stroke study, an 18-month randomized controlled trial 6. Body-Weight–Supported Treadmill Rehabilitation after Stroke
A structured and organized regional healthcare network of resources, the advertising promotion of stroke rehabilitation projects and overcoming economical barriers could positively affect the transferability of the physical activity interventions.	1. Adaptive physical activity with therapeutic patient education / Italy 2. Stationary vs home rehabilitation / Croatia
Identifying the training variables (intensity, frequency, duration, type of exercise) for standardized training programs, that contribute to efficient exercise-based stroke rehabilitation, is required. **Example 1**: A low-intensity exercise program exhibited better results in terms of mobility, quality of life and muscle power compared with a higher-intensity program. **Example 2**: The robotic rehabilitation has an important influence in antispastic treatment of fingers with perspective therapeutic results. **Example 3**: The use of cervical isometric exercises in hemiparetic patients after stroke with dysphagic symptoms was shown to be beneficial	1. Low-intensity endurance and resistance training / Italy 2. Exercise rehabilitation program with experiential music / Greece 3. Rehabilitation with mirror-induced visual illusion / Croatia 4. Amadeo instrument in chronic rehabilitation / Czech Republic 7. Robotic rehabilitation / Czech Republic 8. Cervical isometric exercises / Greece 9. Gait training with KinisiForo System / Lithuania 10. Dual-Task Exercise Reduces Cognitive-Motor Interference in Walking and Falls After Stroke 11. Unilateral Strength Training and Mirror Therapy in Patients

in helping patients improve their cervical spine alignment and overcome deglutition disorders. **Example 4**: After gait training with KinisiForo patients experienced a bigger improvement in gait. **Example 5**: The dual-task program may also be useful in preventing falls and fall-related injuries and may inform the design of fall-prevention programs in this population. **Example 6**: Water-based exercises can improve functional mobility, gait speed, muscle strength and balance.	With Chronic Stroke 12. Effects of Aerobic Training on Physical Activity in People with Stroke: A Randomized Controlled Trial 13. Hydrotherapy vs. conventional land-based exercise for improving walking and balance after stroke: a randomized controlled trial
Individualization of exercise modality may minimize barriers, complications or side-effects, and drop-out. **Example 1**: An individual approach to every stroke patient, with the evaluation of risk factors, comorbidities, socioeconomic situation, age and gender, would enable the most appropriate rehabilitation modality with the best cost-effectiveness. **Example 2**: Group activities provide social support and participation, which improves or preserves the quality of life.	1. Stationary vs home rehabilitation / Croatia 2. Rehabilitation with mirror-induced visual illusion / Croatia 3. Exercise rehabilitation program with experiential music / Greece 4. Physical Fitness Training in Patients with Subacute Stroke Physical Fitness Training in Patients with Subacute Stroke (PHYS-STROKE): multicentre, randomized controlled, endpoint blinded trial 5. Effects of Tai Chi Yunshou exercise on community-based stroke patients: a cluster randomized controlled trial
Enhanced motivation of the stroke patients is necessary to promote adherence to the exercise program, as it can be challenging for individuals with stroke. **Example 1**: The patients positively evaluated the new method used for their rehabilitation. Most of them enjoyed the method of virtual therapy by implementing virtual reality system. This method was useful way	1. Stationary vs home rehabilitation / Croatia 2. Exercise rehabilitation program with experiential music / Greece 3. Virtual reality and traditional physiotherapy / Lithuania 4. Gait training with KinisiForo System / Lithuania 5. Amadeo instrument in chronic rehabilitation / Czech Republic 6. Effects of Aerobic Training on

for the patients to be involved in rehabilitation process. **Example 2**: The music-based exercise program has a positive effect on mood profile in stroke patients and Recovery rate is higher when exercise rehabilitation program was accompanied by an enriched sound environment with experiential music. **Example 3**: An explicitly visualized motivation feedback was evaluated very positively by the patients.	Physical Activity in People with Stroke: A Randomized Controlled Trial
Walking and balance are important functions to recover after stroke. Independent walking is one of the major objectives of stroke rehabilitation. **Example 1**: Whole-body vibration combined with treadmill training might be a high-intensity exercise that can improve the walking performance of patients with chronic stroke. **Example 2**: Wii Fit-based balance rehabilitation could represent a useful adjunctive therapy to traditional treatment to improve static and dynamic balance, functional motor ability, and independence in stroke patients.	1. Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial 2. Whole-Body Vibration Combined with Treadmill Training Improves Walking Performance in Post-Stroke Patients: A Randomized Controlled Trial 3. Dual-Task Exercise Reduces Cognitive-Motor Interference in Walking and Falls After Stroke 4. Hydrotherapy vs. conventional land-based exercise for improving walking and balance after stroke: a randomized controlled trial 5. Gait training with KinisiForo System / Lithuania 6. Effectiveness of Wii-based rehabilitation in stroke: a randomized controlled study
Strengthening the trunk muscles leads to improvement in activities of daily living, including trunk performance and balance.	1. Effect of Core Stability Training on Trunk Function, Standing Balance, and Mobility in Stroke Patients: A Randomized Controlled Trial 2. Land-based and aquatic trunk exercise program improve trunk control, balance and activities of daily living ability in stroke: a randomized clinical trial

APPENDIX

Appendix 1 – International literature review interventions

Title	**Whole-Body Vibration Combined with Treadmill Training Improves Walking Performance in Post-Stroke Patients: A Randomized Controlled Trial**
Date of intervention (Date)	03/2017
Country of intervention	Seoul, Republic of Korea
Study type	An assessor-blind randomized controlled trial
Intervention group size	15
Control group size	15
Gender mix (% of males)	whole-body vibration combined with treadmill training (WBV-TT) group: 53%, treadmill training (TT) group: 73%
Mean age	TT-WBV group: 51.93, TT group: 53.67 years
Intervention length	6 weeks
Assessment periods	Baseline , completion of the intervention
Identified issues	Treadmill training has limitations in using compensation strategies rather than recovery of normal kinetic symmetry. Therefore, stimulation that induces sensory messages from cutaneous or muscle proprioceptive receptors is needed to promote the use of the affected side instead of excessive use of the less affected side.
Aim	To investigate the effects of whole-body vibration combined with treadmill training (WBV-TT) on walking performance in patients with chronic stroke.
Intervention details	The participants in the WBV-TT group performed exercises on a vibrating platform, 3 times a week, for 4.5 minutes per session. Each session included 6 exercises on a vibrating platform and each exercise was conducted for 45 seconds. A break time of 1 minute was given between the exercises. The frequency of WBV stimulation was increased gradually by 5 Hz every 2 weeks, from 20 Hz to 30 Hz. Thereafter, treadmill training was carried out for 20 minutes. The participants defined their maximum walking speed on the first day of every week and it was increased gradually by 5% during the walk.
Comparison group: details of usual care	The participants in the TT group conducted the same exercise on a platform without vibration and then walked on the treadmill in the same manner.

Outcome measures	The temporospatial parameter of gait (GAITRite) and 6-minute walk test.
Results	The WBV-TT group showed significant improvements in walking performance with respect to walking speed, cadence, step length, stride length, single-limb support, double-limb support, and 6-minute walk test compared with baseline
Other outcomes and results	Significant improvements were also seen in walking speed, step length, stride length, and double-limb support compared with the TT group. In the 6MWT, both groups were significantly improved but there was no significant difference between them.
Limitations	Small sample size, necessary the assistance of a therapist, the subject needs to have basic walking ability, bring able to walk on a treadmill at a speed of at least 0.8 km/h
Conclusions	WBV-TT might be a more intensive and effective training program than TT for improving walking performance of patients with chronic stroke.
Abstract link	https://pubmed.ncbi.nlm.nih.gov/29031023/
Full link	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5652248/

Title	**Dual-Task Exercise Reduces Cognitive-Motor Interference in Walking and Falls After Stroke: A Randomized Controlled Study**
Date of intervention (Date / Year)	October 2014 to May 2016
Country of intervention	China/ Canada
Study type	A single-blind randomized controlled trial
Intervention group size	dual-task training group= 28, single- task training group=28
Control group size	The upper limb exercise group: 28
Gender mix (% of males)	All: 71.42%, dual-task group: 78.5%, single- task group:71.4%, control group: 64.2%
Mean age	All: 61.2y, dual-task group: 59.9, single- task group: 61.2, control group: 62.4
Intervention length	8 weeks
Assessment periods	Baseline, within 1 week after the intervention, and 8 weeks after the intervention. Fall incidence was recorded for a 6-month period post-training.
Identified issues	Falls may not be a result of balance deficits in isolation but the inability to effectively allocate attention to balance

	in dual-task contexts. The value of dual-task exercise training on dual-task balance/mobility function in individuals after stroke remains largely unclear
Aim	To evaluate the effects of a dual-task balance/mobility exercise program on dual- task interference during walking, fall incidence, balance self- efficacy, participation in daily activities, and quality of life in individuals with chronic stroke.
Intervention details	Each group received their respective training (three 60-minute sessions per week) for 8 weeks. Each training session was supervised by 2 instructors with physical therapy background, with an instructor to participant ratio of 2:4.
Comparison group: details of usual care	The upper-limb exercise group served as an active control group, to determine whether the observed improvement in the dual-or single-task group was a function of maturation or repeated testing.
Outcome measures	Dual-task interference effect measured with 3 mobility tests (forward walking, timed-up-and-go, and obstacle crossing) and two cognitive tasks (verbal fluecy task and mental tracking task).The degree of dual-task interference was represented by the percent dual-task effect (DTE%) of the walking time and CRR (The correct response rate of the cognitive tasks). Activities-specific Balance Confidence (ABC) scale, the Frenchay Activities Index, and the Stroke-Specific Quality of Life Scale (SS-QOL). Incidence of falls and fall-related injuries for 6 months
Results	Only the dual-task group exhibited reduced dual-task interference in walking time post-training. The improvements in dual-task walking were largely maintained at the 8-week follow-up. The dual-task cognitive performance showed no significant changes.
Other outcomes and results	The dual-task program, had no significant effect on activity participation or quality of life.
Limitations	Only 2 cognitive domains were involved in our testing paradigm (verbal fluency, mental tracking) and the other were not examined. Small sample size. Individuals in the acute or subacute stage of stroke were not included. The participants may have been more physically and socially active, had a higher education level, or socioeconomic status than their counterparts who did not participate in the study. The exercise sessions were not held at the same time of the day

Conclusions	The dual-task program was effective in improving dual-task mobility, reducing falls and fall-related injuries in ambulatory chronic stroke patients with intact cognition
Abstract link	https://pubmed.ncbi.nlm.nih.gov/30571419/
Full link	https://www.ahajournals.org/doi/full/10.1161/STROKEAHA.118.022157?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed

Title	**Body-Weight–Supported Treadmill Rehabilitation after Stroke**
Date of intervention (Date / Year)	From April 2006 through June 2009
Country of intervention	California and Florida, USA
Study type	Single-blinded, randomized controlled trial
Intervention group size	Early locomotor training (LT) =139, Late locomotor training (LT)=143
Control group size	Home exercise program(HE) =126
Gender mix (% of males)	Early LT= 61.2 %, Late LT= 51.7%, HE= 51.6%
Mean age	Early LT= 60.1, Late LT= 63.3, HE= 62.6
Intervention length	12 to 16 weeks
Assessment periods	Baseline (2 months), 6 and 12 months after the occurrence of stroke
Identified issues	Locomotor training, including the use of body-weight support in treadmill stepping, is a physical therapy intervention used to improve recovery of the ability to walk after stroke. The effectiveness and appropriate timing of this intervention have not been established
Aim	To evaluate the effectiveness of a locomotor training in increasing the proportion of participants with higher functional walking levels 1 year after the stroke. To evaluate the appropriate timing of a locomotor training and also to evaluate if early locomotor training would improve walking speed more than late locomotor training.
Intervention details	The programs were controlled for exercise frequency (90-minute sessions, three times per week).

	Participants had to complete between 30 and 36 exercise sessions within this period. Participants also received usual care during the study period. Locomotor training included stepping on a treadmill with partial body-weight support and manual assistance as needed for 20 to 30 minutes at 3.2 km per hour, followed by a progressive program of walking over ground for 15 minutes.
Comparison group: details of usual care	The home-exercise program was designed as not a high-intensity, task- specific walking program. Progression through the program was managed by a physical therapist in the home, with the goals of enhancing flexibility, range of motion in joints, strength of arms and legs, coordination, and static and dynamic balance.
Outcome measures	The proportion of participants with an improved functional level of walking 1 year after the stroke. Changes at 1 year in the speed at which participants walked a distance of 10 m, the distance walked in 6 minutes, and the number of steps taken per day as measured by an activity monitor. Scores on the Fugl- Meyer Assessment of Motor Recovery in the legs, the Berg Balance Scale, the Activities-Specific Balance Confidence Scale, the Activities of Daily Living–Instrumental Activities of Daily Living (ADL–IADL) Scale, and the physical mobility and participation domains of the Stroke Impact Scale.
Results	At 1 year, 52.0% of all participants had increased functional walking ability. No significant differences in improvement were found between early and late locomotor training compared with home exercise. All groups had similar improvements in walking speed, motor recovery, balance, functional status, and quality of life. Neither the delay in initiating the late locomotor training nor the severity of the initial impairment affected the outcome at 1 year.
Other outcomes and results	Ten related serious adverse events were reported. As compared with the home-exercise group, each of the groups receiving locomotor training had a higher frequency of dizziness or faintness during treatment. Among patients with severe walking impairment, multiple falls were more common in the group receiving early locomotor training than in the other two groups.

Limitations	The lack of a group receiving no physical therapy
Conclusions	Locomotor training, including the use of body-weight support in stepping on a treadmill, was not shown to be superior to progressive exercise at home managed by a physical therapist.
Abstract link	https://pubmed.ncbi.nlm.nih.gov/21612471/
Full link	https://www.nejm.org/doi/full/10.1056/NEJMoa1010790 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3175688/

Title	**Unilateral Strength Training and Mirror Therapy in Patients With Chronic Stroke**
Date of intervention (Date / Year)	November 2015 and May 2017
Country of intervention	Ireland
Study type	A pilot randomized controlled parallel group study
Intervention group size	mirror and Strength training (MST)= 17
Control group size	Strength training (ST)= 15
Gender mix (% of male)	MST group = 55.5%, ST group=64.7%
Mean age	MST group= 63.5, ST group=61.1
Intervention length	4 weeks
Assessment periods	Baseline measurements (T1, within 7 days of intervention beginning), and post intervention assessment (T2) , at least 48 hrs, but no longer than 7 days after the last training session.
Identified issues	Motor recovery after stroke is attributed to brain plasticity. Treatment methods with the potential to augment cross-education need to be investigated. There is evidence that a mirror can augment the cross-education effect and it is recommended to explore the possible use of the intervention poststroke.
Aim	To investigate the feasibility and potential of unilateral strength training (ST) combined with mirror therapy in poststroke upper limb motor recovery. The primary feasibility objectives were (a) to examine participant compliance, (b) to evaluate adverse effects,

	and (c) to assess the suitability of outcome measures.
Intervention details	A home-based training program performed three times a week lasted approximately 20 mins, for 4 wks (12 sessions) under constant supervision of two exercise therapists. All participants sat comfortably in a chair in front of their own kitchen table, and performed the same unilateral maximal isometric ST program. To perform contractions, the less-affected upper limb was strapped into an arm brace consistently holding the elbow joint at an 85-degree angle, the more-affected arm was resting on the table. Participants in the MST group viewed a reflection of their less-affected limb in a Perspex mirror positioned in their midsagittal plane while strengthening. Prompts to focus on the mirror reflection were given to the MST group only
Comparison group: details of usual care	Verbal cues were identical for all participants of both groups.
Outcome measures	Participant compliance, adverse effects, and suitability of outcome measures assessed feasibility. Maximal voluntary isometric elbow extension strength, Spasticity, The Chedoke Arm and Hand Activity Inventory Version 8 (CAHAI-8), The ABILHAND questionnaire, The London Handicap Scale (LHS)
Results	Compliance was high with no adverse effects. There was a 9% dropout rate. No statistically significant between-group differences were found for any of the outcome measures. Mirror therapy did not augment the cross-education effect in patients with chronic stroke when training isometrically. There was no significant between-group effect for the LHS. However, participants in the MST group experienced a significant improvement of 7% ($P = 0.04$) from preintervention to postintervention.
Other outcomes and results	The treatment effect for peak torque and the highest average torque in favor of the MST group was moderate to large in size. Outcome measures used in this study suggest that measurement of spasticity, motor recovery, and patient participation may potentially identify nonstrength benefits.
Limitations	The sample size was relatively small, the training intensity was not measured during home-based ST sessions, and

	the study did not control for placebo effects.
Conclusions	Mirror therapy did not augment cross-education when training isometrically. The combination of interventions may be worth investigating further when applying an improved training protocol.
Abstract link	https://pubmed.ncbi.nlm.nih.gov/31318745/
Full link	https://journals.lww.com/ajpmr/Fulltext/2019/08000/Unilateral_Strength_Training_and_Mirror_Therapy_in.4.aspx

Title	**Effect of Core Stability Training on Trunk Function, Standing Balance, and Mobility in Stroke Patients: A Randomized Controlled Trial.**
Date of intervention (Date / Year)	September 2013 and December 2014
Country of intervention	Tokyo, Japan
Study type	An assessor-blinded, randomized controlled trial
Intervention group size	16
Control group size	16
Gender mix(% of males)	Experimental group =81.2% Control group =75%
Mean age	Experimental group=67.56, Control group= 65.63
Intervention length	4 weeks
Assessment periods	before and after the intervention.
Identified issues	Trunk function is important for standing balance, mobility, and functional outcome after stroke. It is not yet clear which types of trunk training are more useful to improve trunk performance in stroke patients.
Aim	To investigate the effectiveness of core stability training in comparison with a conventional comprehensive rehabilitation program, on trunk function, standing balance, and mobility in stroke patients
Intervention details	Physical therapy for approximately 60 min/day, five times a week was provided in both groups. In the experimental group, patients received 20 minutes of core stabilization

	exercises within each daily training. In total, each patient received 400 minutes of training time.
Comparison group: details of usual care	Participants in the control group received a conventional physical therapy program, including general trunk exercises. Therapists were provided an explanations based on the protocol and practiced that protocol for 1 month prior to performing therapy for the study.
Outcome measures	Trunk function evaluation using the Trunk Impairment Scale (TIS) and its subscales (Static sitting balance, Dynamic sitting balance, Coordination). Motor ability and flexibility of the lower trunk evaluation by pelvic tilt active range of motion in the sagittal plane, the Balance Evaluation Systems Test–brief version (Brief-BESTest), Functional Reach test, Timed Up-and-Go test (TUG), and Functional Ambulation Categories (FAC).
Results	Core stability training improved balance and mobility, in addition to trunk function, more than the conventional physical therapy program in stroke patients.
Other outcomes and results	There were improvements in pelvic AROM angle.
Limitations	Small number of subjects, lack of quantitative assessment of the success of core stability training. Nonblinding was less than ideal. The effects of core stability training on ADL and quality of life remain unclear. There were no follow-up assessments.
Conclusions	Core stability training has beneficial effects on trunk function, standing balance, and mobility in stroke patients.
Abstract link	https://pubmed.ncbi.nlm.nih.gov/27821673/
Full link	https://journals.sagepub.com/doi/full/10.1177/1545968316675431?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed

Title	**A physical activity intervention to prevent cognitive decline after stroke: secondary results from the life after stroke study, an 18-month randomized controlled trial**
Date of intervention (Date / Year)	Between October 2011 and January 2016
Country of intervention	Norway
Study type	A prospective, randomized, single-blinded, multicentre, 2-arm parallel group clinical trial.
Intervention group size	177
Control group size	185
Gender mix(% of men)	Intervention group=56 , Control group=65 (60.5% males)
Mean age	Intervention group = 71.4 , Control group= 72.0
Intervention length	18 months
Assessment periods	Baseline, 18 months
Identified issues	Multifactorial interventions aiming to prevent post-stroke cognitive decline have not been shown to be effective, possibly due to heterogeneity, short follow-ups, and low intensity.
Aim	To examine the effects of individualized regular coaching and exercise on post-stroke cognitive and emotional function.
Intervention details	In addition to usual care, the intervention group received regular individualized coaching performed by physiotherapists, aiming to achieve physical activity 30 min daily, and 45–60 min physical exercise including 2–3 bouts of vigorous activity every week.
Comparison group: details of usual care	The patients were treated in the acute and subacute phase according to international and national guidelines from 2011. Risk assessment and individualized secondary prevention was initiated at discharge from hospital after the index stroke, with recommendation for long-term risk factor control as part of usual care.
Outcome measures	Cognitive function was measured using standardized neuropsychological tests assessing for global function, processing speed and executive function: Trail Making Test (TMT) A and B, Mini Mental State Examination (MMSE), Hospital Anxiety and Depression Scale (HADS), and adherence to the intervention using self-reported activity through the diaries.

Results	Measures of cognitive function and emotional symptoms showed a slight decline in both groups during follow-up. The adjusted mean difference between groups for TMT A was 8.54 (95% CI 0.7 to 6.3), p = 0.032, for TMT B 8.6 (95% CI –16.5 to 33.6), p = 0.50, for MMSE –0.1 (95% CI –0.8 to 0. 6), p = 0.77, for HADS A –0.2 (95% CI –0.9 to 0.5), p = 0.56 and for HADS D –0.1 (95% CI –0.7 to 0.5), p = 0.76).
Other outcomes and results	A higher level of adherence to the intervention was significantly associated with increased MMSE (B = 0.030 (95% CI 0.005–0.055), p = 0.020).
Limitations	The study population may, due to the rather high mean age, have been too heterogeneous regarding both underlying additional degeneration and comorbidities. Only mild-to-moderate strokes were included. HADS, MMSE and the Trail Making Tests are primarily designed as screening tools and might not be sensitive to detect changes that occur during follow-up after stroke. Functional impairments in the dominant arm/hand may have affected the results on the cognitive test performance. The actual performed training is self-reported regarding both length and intensity.
Conclusions	No clinically relevant effects on cognitive or emotional function were found of individualized regular coaching for physical activity and exercise. However, increased adherence to the intervention was associated with improved cognitive function
Abstract link	https://pubmed.ncbi.nlm.nih.gov/31440765/
Full link	https://www.medicaljournals.se/jrm/content/html/10.2340/16501977-2588

Title	**Effects of Tai Chi Yunshou exercise on community-based stroke patients: a cluster randomized controlled trial**
Date of intervention (Date / Year)	March 2014
Country of intervention	China
Study type	A single-blind cluster randomized, parallel-controlled trial
Intervention group size	112
Control group size	113

Gender mix(% of male)	74,6%
Mean age	60.9 y
Intervention length	12 weeks
Assessment periods	At baseline and at the end of week 4, week 8, and week 12 of the intervention, as well as at 6-week follow-up (week 18) and 12-week follow-up (week 24).
Identified issues	Tai Chi Chuan was used for stroke survivors with balance impairments. However, even a short-form of Tai Chi Chuan includes forms that make the exercise challenging for the stroke survivors. Tai Chi Yunshou (wave hands in the cloud) is the “mother” form and the fundamental form of all Tai Chi Chuan styles, which is considered more suitable and feasible for stroke survivors with balance impairments.
Aim	To evaluate the effects of Tai Chi Yunshou exercise on community-based stroke patients with balance dysfunctions.
Intervention details	All subjects completed a 12-week intervention. Tai Chi Yunshou exercise occurred five times per week for 60 min each session.
Comparison group: details of usual care	Balance rehabilitation training was also carried out five times per week for 60 min each session. The balance rehabilitation training includes static balance training, dynamic balance training, bobath training, walking training and so on according to the patient’s functional level and condition.
Outcome measures	Outcome assessments included Berg Balance Scale (BBS), Time up to go test (TUGT) and Modified Barthel Index (MBI). Static balance was measured by Single Leg Stance Test (SLST). Fear of falling was measured by Chinese version of Modified Falls Efficacy Scale (MFES), Chinese version SF-36 and Beck Depression Inventory (BDI)
Results	There was no siginificant difference in Tai Chi Yunshou and balance rehabilitation training on the improvement of balance ability and mobility. There was significant difference between two groups on improvement of motor funtion ($P = 0.022$), fear of falling ($P < 0.001$) and depression ($P = 0.035$) for the post stroke patients
Other outcomes - results	No adverse events were reported during the study.
Limitations	The participants were not blinded. The participants did not record their daily exercise. There was no supervision during the follow-up period. The intensity of the two interventions

	was not estimated.
Conclusions	Tai Chi Yunshou and balance rehabilitation training led to improved balance ability and functional mobility, and both are suitable community-based programs that may benefit for stroke recovery and community reintegration.
Abstract link	https://pubmed.ncbi.nlm.nih.gov/30564291/
Full link	https://eurapa.biomedcentral.com/articles/10.1186/s13556-018-0206-x

Title	**Physical Fitness Training in Patients with Subacute Stroke (PHYS-STROKE): multicentre, randomised controlled, endpoint blinded trial**
Date of intervention (Date / Year)	26 Sep 2013 – 30 Apr 2017
Country of intervention	Germany
Study type	Multicenter, randomized controlled, endpoint blinded trial
Intervention group size	105
Control group size	95
Gender mix (% of males)	Usual care: 62%, Intervention: 57%
Mean age	Usual care: 69.0 yrs, Intervention: 70.0 yrs
Intervention length	4 weeks
Assessment periods	Baseline, 4 weeks, 3 months post-program, 6 months post-program
Identified issues	Treadmill based physical fitness training constitutes a non-drug approach in stroke rehabilitation that might not only prevent deconditioning but also show associated benefits on activities of daily living.
Aim	To determine the efficacy of aerobic treadmill based, physical fitness training on maximal walking speed and activities of daily living compared with relaxation as a control intervention in adults with stroke in the early subacute phase (days 5-45 after stroke).
Intervention details	Participants received either aerobic, bodyweight supported, treadmill based physical fitness training or relaxation sessions, each for 25 minutes, five times weekly for four weeks, in addition to standard rehabilitation therapy.
Comparison group: details of usual care	Relaxation sessions were performed as an active control and focused on contraction and relaxation of muscle groups in the face, arms, shoulders, back, and abdomen. Standard care was delivered following the German

	guidelines for neurorehabilitation after stroke.
Outcome measures	Change in maximal walking speed (m/s) in the 10 m walking test and in Barthel index scores (range 0-100 points, higher scores indicating less disability) three months after stroke compared with baseline. Safety outcomes were recurrent cardiovascular events, including stroke, hospital readmissions, and death within 3 months after stroke.
Results	Compared with relaxation, aerobic physical fitness training did not result in a significantly higher mean change in maximal walking speed (adjusted treatment effect 0.1 m/s (95% confidence interval 0.0 to 0.2 m/s), P=0.23) or mean change in Barthel index score (0 (−5 to 5), P=0.99) at three months after stroke.
Other outcomes and results	A higher rate of serious adverse events was observed in the aerobic group compared with relaxation group (incidence rate ratio 1.81, 95% confidence interval 0.97 to 3.36).
Limitations	Recruitment between days 5 and 45 after stroke; the aerobic physical fitness training group was more severely affected at baseline; findings are only applicable to moderately to severely affected adults with subacute stroke; less than 4% of the screened adults with stroke were included in the trial; the intervention period of four weeks could have been too short.
Conclusions	A 4-week intervention of a bodyweight supported, treadmill based, aerobic physical fitness training in adults in the subacute phase of moderate to severe stroke is not superior to relaxation sessions with regard to maximal walking speed and activities of daily living. The risk of falls was higher in participants randomized to aerobic physical fitness training.
Abstract link	https://pubmed.ncbi.nlm.nih.gov/31533934/
Full link	https://www.bmj.com/content/bmj/366/bmj.l5101.full.pdf

Title	Land-based and aquatic trunk exercise program improve trunk control, balance and activities of daily living ability in stroke: a randomized clinical trial
Date of intervention (Date / Year)	2018
Country of intervention	Korea
Study type	Single-blind randomized controlled trial
Intervention group size	14
Control group size	15
Gender mix (% of males)	Usual care: 80.0%, Intervention: 71.4%
Mean age	Usual care: 57.1 yrs, Intervention: 56.2 yrs
Intervention length	4 weeks
Assessment periods	Baseline, 4 weeks
Identified issues	No study has reported the effects of an exercise program that combines land-based and aquatic trunk exercises in stroke patients.
Aim	To investigate the effects of a land-based and aquatic trunk exercise (LATE) program on trunk control, balance, and activities of daily living in chronic stroke patients.
Intervention details	The LATE program consisted of land-based and aquatic trunk exercises, performed for 30 minutes per day, 5 days per week, for 4 weeks as an adjunct to 30 minutes of conventional physical therapy.
Comparison group: details of usual care	The control group underwent only conventional physical therapy for 30 minutes each time, twice per day, 5 days per week, for 4 weeks.
Outcome measures	Korean Trunk Impairment Scale (K-TIS) and the 5-item, 3-level Postural Assessment Scale for Stroke (PASS-3L) to assess trunk control; the 7-item, 3-level Berg Balance Scale (BBS-3L) and the Functional Reach Test (FRT) to evaluate balance; and the Modified Barthel Index (MBI) to assess activities of daily living.
Results	The LATE group exhibited improvements in K-TIS, PASS-3L, BBS -3L, and MBI scores and distance compared with the control group.
Other outcomes and results	The land-based and aquatic trunk exercise program can also improve postural control and independence in the daily activities of stroke patients.
Limitations	The study participants were hospitalized patients admitted to a hospital located in one area; small sample size; no follow up after the end of the 4-week exercise regimen.
Conclusions	Trunk control, balance, and activities of daily living significantly improved with a land-based and aquatic trunk exercise program in stroke patients.

Abstract link	https://pubmed.ncbi.nlm.nih.gov/30370752/
Full link	https://www.minervamedica.it/en/getfreepdf/MXM3RUhhSXJvNDlmdTl2YXdDY2dLc0xhTldTR2l3Vm82ZGpZbk90YlMwWWdWejN3cmorMGdmSWc1eUUxUFJYQg%253D%253D/ R33Y2019N06A0687.pdf

Title	**Effects of Twice-Weekly Intense Aerobic Exercise in Early Subacute Stroke: A Randomized Controlled Trial**
Date of intervention (Date / Year)	2011-2013
Country of intervention	Sweden
Study type	Randomized controlled trial.
Intervention group size	29
Control group size	27
Gender mix (% of males)	Usual care: 52%, Intervention: 48%
Mean age	Usual care: 70.4 yrs, Intervention: 71.3 yrs
Intervention length	3 months
Assessment periods	Baseline, 3 months, 6 months
Identified issues	The outcomes of exercise rehabilitation programs in stroke patients regarding their walking speed and balance are unclear or conflicting, and the outcome on quality of life is also not fully explored.
Aim	To examine the effects of 12 weeks of twice-weekly intensive aerobic exercise on physical function and quality of life after subacute stroke.
Intervention details	Sixty minutes of group aerobic exercise, including 2 sets of 8 minutes of exercise with intensity up to exertion level 14 or 15 of 20 on the Borg rating of perceived exertion scale, twice weekly for 12 weeks.
Comparison group: details of usual care	The nonintervention group (nZ27) received no organized rehabilitation or scheduled physical exercise.
Outcome measures	Aerobic capacity on the standard ergometer exercise stress test (peak work rate) and walking distance on the 6-minute walk test (6MWT). Secondary outcome measures included maximum walking speed for 10m, balance on the timed Up and Go (TUG) test and single leg stance (SLS), health-related quality of life on the European Quality of Life Scale (EQ-5D), and participation and recovery after stroke on the Stroke Impact Scale (SIS) version 2.0 domains 8 and 9.

Results	The following improved significantly more in the intervention group (pre- to postintervention): peak work rate, 6MWT, maximum walking speed for 10m, TUG test, SLS right and left (eyes open), and SLS right (eyes closed). Aerobic exercise was associated with improved EQ-5D scores (visual analog scale) and perceived recovery (SIS domain 9).
Other outcomes and results	The patient-reported improvements persisted at 6-month follow-up.
Limitations	1.Possibly, those who agreed to participate in this study were mainly patients with an interest in training. 2. The previous fitness level, training activities, or functional performance of the patients prior to stroke were not registered. 3. The study did not gather any information about each patient's activity levels during and after the intervention. 4. Small sample size. 5. Multiple outcome measures were reported, which might increase the possibility of type I error (ie, saying there is a difference when there is not one). 6. Only patients ≥50 yrs old were accepted.
Conclusions	Intensive aerobic exercise twice weekly early in subacute mild stroke improved aerobic capacity, walking, balance, health-related quality of life, and patient-reported recovery.
Abstract link	https://pubmed.ncbi.nlm.nih.gov/26903147/
Full link	http://liu.diva-portal.org/smash/get/diva2:930247/FULLTEXT01.pdf

Title	**Effects of aerobic training on physical activity in people with stroke: a randomized controlled trial**
Date of intervention (Date / Year)	August 2018 – December 2018
Country of intervention	Brazil
Study type	Randomized controlled single blinded trial
Intervention group size	11
Control group size	11
Gender mix (% of males)	Usual care: 73%, Intervention: 73%
Mean age	Usual care: 48.0 yrs, Intervention: 52.0 yrs
Intervention length	12 weeks
Assessment periods	Baseline, 12 weeks, 16 weeks
Identified issues	Since the maintenance of cardiorespiratory fitness is a significant predictor of physical activity levels post-stroke, it is important to investigate whether aerobic training is

	effective in increasing physical activity levels and reducing the time spent in low-energy expenditure activities in stroke patients.
Aim	To investigate the effects of aerobic treadmill training on physical activity levels and time spent in low-energy expenditure activities, as well as on cardiorespiratory fitness, endurance, depression, mobility, quality of life and participation after stroke.
Intervention details	Aerobic treadmill training at 60–80% of heart rate reserve with three 40 min sessions/week.
Comparison group: details of usual care	Outdoor-overground walking below 40% of heart rate reserve with three 40 min sessions/week.
Outcome measures	Physical activity levels and time spent in low-energy expenditure activities (multi-sensor activity monitor: SenseWear Mini® & Human Activity Profile), cardiorespiratory fitness (VO_2peak & VO_2ventilatory threshold), depression (Patient Health Questionnaire-2 and -9), endurance (Six-Minute Walk Test and Incremental Shuttle-Walk Test), mobility (both comfortable and maximum speeds during the 10-meter Walk Test), participation (participation section of the Stroke Impact Scale 3.0), quality of life (Stroke-Specific Quality of Life scale).
Results	No changes in physical activity levels and time spent in low-energy expenditure activities were found for any of the groups. The experimental group showed greater improvements in quality of life at 16-week follow-up (13 points).
Other outcomes and results	Both groups improved depression (2.2 points), endurance (Six-minute walk test: 31 m &, Incremental shuttle-walk test: 55 m) and mobility (0.12m/s).
Limitations	Convenient sample; not double blinded study.
Conclusions	Neither treadmill or outdoor-overground walking led to changes in physical activity levels and time spent on low-energy expenditure activities of people with chronic stroke.
Abstract link	https://pubmed.ncbi.nlm.nih.gov/30119697/
Full link	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6098648/pdf/ 13063_2018_Article_2823.pdf

Title	**Effectiveness of Wii-based rehabilitation in stroke: a randomized controlled study**
Date of intervention (Date / Year)	October 2009 - August 2011

Country of intervention	Turkey
Study type	Randomized controlled blinded trial
Intervention group size	12
Control group size	11
Gender mix (% of males)	Usual care: 83.3%, Intervention: 71.4%
Mean age	Usual care: 64.1 yrs, Intervention: 62.3 yrs
Intervention length	4 weeks
Assessment periods	Baseline, 4 weeks, 8 weeks
Identified issues	There are conflicting results in the literature about the efficacy of Wii-based balance exercises in stroke patients.
Aim	To investigate the efficacy of Wii Fit-based balance rehabilitation as an adjunctive therapy to conventional rehabilitation in stroke patients.
Intervention details	The experimental group received 20 min of balance exercise, 5 days/week, for 4 consecutive weeks, with Wii Fit and Wii Balance Board, in addition to conventional rehabilitation.
Comparison group: details of usual care	Conventional neurological rehabilitation program with balance rehabilitation exercises for 2–3 h/day, 5 days/week. Conventional rehabilitation also included a tailored to the patients' requirements program of neurodevelopmental facilitation techniques, physiotherapy, occupational therapy, and cognitive therapy.
Outcome measures	Berg Balance Scale, Functional Reach Test, Postural Assessment Scale for Stroke Patients, Timed Up and Go Test and Static Balance Index. Secondary outcome measures were postural sway, as assessed with Emed-X, Functional Independence Measure Transfer and Ambulation Scores.
Results	Group-time interactions were significant in the Berg Balance Scale, Functional Reach Test, anteroposterior & mediolateral center of pressure displacement (eyes open), anteroposterior center of pressure displacement (eyes closed), center of pressure displacement during weight shifting to affected side, to unaffected side and total center of pressure displacement during weight shifting.
Other outcomes and results	While both groups exhibited significant improvements, the experimental group showed greater benefits.
Limitations	A more intense and longer application of Wii Fit could increase the effectiveness of the rehabilitation; the short follow-up period following the completion of the exercise program; Inclusion of chronic stroke patients.

Conclusions	Wii Fit-based balance rehabilitation could represent a useful adjunctive therapy to traditional treatment to improve static and dynamic balance, functional motor ability, and independence in stroke patients.
Abstract link	https://pubmed.ncbi.nlm.nih.gov/29620137/
Full link	https://www.medicaljournals.se/jrm/content/html/10.2340/16501977-2331

Title	**Hydrotherapy vs. conventional land-based exercise for improving walking and balance after stroke: a randomized controlled trial**
Date of intervention (Date / Year)	February 2012 - October 2014
Country of intervention	China
Study type	Single-blind, randomized controlled pilot trial
Intervention group size	14
Control group size	14
Gender mix (% of males)	Usual care: 71%, Intervention: 86%
Mean age	Usual care: 57.1 yrs, Intervention: 56.6 yrs
Intervention length	4 weeks
Assessment periods	Baseline, 4 weeks
Identified issues	Aquatic therapy can achieve optimal mobility in patients with neurological disorders; however, few studies have compared the effects of short-term (four weeks) aquatic exercise with land-based exercise in stroke survivors.
Aim	To investigate the effects of hydrotherapy on walking ability and balance in chronic stroke (patients with impairments in walking and controlling balance more than six months post-stroke).
Intervention details	Individual aquatic exercise sessions 5 days/week, for 45 minutes per session.
Comparison group: details of usual care	Individual land-based exercise sessions 5 days/week, for 45 minutes per session.
Outcome measures	Functional assessments included the Functional Reach Test, Berg Balance Scale, 2-minute walk test, and Timed Up and Go Test
Results	The Berg Balance Scale, Functional Reach Test, 2-minute walk test, and the Timed Up and Go Test scores had improved significantly in each group. The mean improvement of the Functional Reach Test and 2-minute walk test were significantly higher in the aquatic group than in the land-

	based one.
Other outcomes and results	The differences in the mean values of the improvements in the Berg Balance Scale and the Timed Up and Go Test were not statistically significant.
Limitations	Small sample size; lack of any follow-up.
Conclusions	Even a relative short hydrotherapy program of 4 weeks should be considered as an effective tool for improving postural balance and mobility in chronic stroke patients.
Abstract link	https://pubmed.ncbi.nlm.nih.gov/26130657/
Full link	https://journals.sagepub.com/doi/pdf/10.1177/0269215515593392

Interventions Rating Questionnaire

Title:

_____
_____
_____

1. How would you rate the overall quality of the intervention?
   (1=very poor, 5=very good)

   1 2 3 4 5
   ☐ ☐ ☐ ☐ ☐

2. Rate the effectiveness of the intervention in increasing the patient attendance in stroke rehabilitation.
   (1=ineffective, 5=very effective)

   1 2 3 4 5 N/A
   ☐ ☐ ☐ ☐ ☐ ☐

3. How valuable is the intervention for the following groups?
   (1=not at all, 5=very much)

   - Patients 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ N/A ☐
   - Healthcare personnel ☐ ☐ ☐ ☐ ☐ ☐
   - Other: _____ ☐ ☐ ☐ ☐ ☐ ☐

     _____

4. How much effort is required from the following groups?
   (1=very little, 5=very much)

   - Patients 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ N/A ☐
   - Healthcare personnel ☐ ☐ ☐ ☐ ☐ ☐
   - Other: _____ ☐ ☐ ☐ ☐ ☐ ☐

5. Would you recommend this intervention to be implemented on a larger scale?

   - ☐ No
   - ☐ Not without conducting further trials.
   - ☐ Yes, I would recommend to introduce it in one institution.
   - ☐ Yes, I would recommend to introduce it in more than one institution.
   - ☐ I would even consider national dissemination after some further trials.
   - ☐ Other: _____

6. Have you perceived any limitations other than the ones identified in the study?

   - ☐ Yes
     If yes, what are these? _____

   - ☐ No

7. Overall, how would you rate the seriousness of these limitations - those identified by you plus those identified by the study?
   (1=not at all serious, 5=very serious)

   1 2 3 4 5
   ☐ ☐ ☐ ☐ ☐

8. Do you have any ideas about modifying some conditions of the intervention for better results?
   _____
   _____
   _____
   _____

9. Please evaluate and grade the following variables (with a maximum score of 100 in each of the indicator categories):

   a. Relevance of the intervention: _____
   - An intervention is considered relevant when it is able to satisfy the identified needs of the stakeholders and is also valuable to the said groups. Relevance can also be interpreted across time and place; the closer it is to the present and the location of the study, the higher the relevance.

   b. Quality of the intervention: _____
   - Quality is the ongoing process of building and sustaining relationships by assessing, anticipating, and fulfilling stated and implied needs. The quality of the intervention can be evaluated objectively (by the size of the intervention and the control group, the gender mix,

the number of assessment periods and the total length of the intervention), as well as subjectively (by the described experiences and observations from the participants).

c. Sustainability of the intervention: _____

- An important factor to be considered is whether the positive effects of the intervention outlast the project, providing future benefits even without further investment.

d. Effectiveness of the intervention: _____

- Effectiveness is the capability of producing a desired result. An intervention is considered effective when it has been evaluated and the final results show to have reached its target for specific indicators with a determined agreed tolerance. One important indicator of effectiveness is the number and seriousness of the limitations characterizing the studies. Another factor related to effectiveness is the complexity of outcome measures (deliberate application of well-defined outcome measures increases the effectiveness score of the interventions).

Appendix 3 – Partner country interventions form

Country:

Title	
Basic details	*Beginning / end of intervention (dates)*
	Place of intervention
Patients' characteristics	*Type of stroke*
	Intervention group size
	Gender (%males)
	Mean age
Intervention details	*Identified issues*
	Aim
	Description
	Results
	Strengths of the intervention, Weaknesses of the intervention, Conclusions, Recommendations, Special features
Measurement	*Across time (were the results compared with pre-intervention periods?)* *Across place (were the results compared with another setting?)* *Across a comparison group (in the same institution)*
Publicity	*Has the intervention been presented or published?*

Appendix 4 - Partner country interventions

Croatia

Title	**Filipović B. DIFFERENCES IN FUNCTIONAL RECOVERY AND QUALITY OF LIFE OF PATIENTS WITH STROKE BETWEEN STATIONARY AND HOME REHABILITATION. [Doctoral thesis]. Zagreb: University of Zagreb, Faculty of Kinesiology; 2015. Available at: https://urn.nsk.hr/urn:nbn:hr:117:447858**
Basic details	Beginning / end of intervention (dates) N/A
	Place of intervention University Hospital Center 'Sestre milosrdnice', Zagreb
Patients' characteristics	Type of stroke Hemorrhagic and ishemic, NIHSS between 5 and 15
	Intervention group size 60 patient in total 30 in stationary rehabilitation, 30 in home rehabilitation
	Gender (%males) 50%
	Mean age in total 71 (male = 65, female=75) Mean age in stationary rehabilitation=69, in home rehabilitation=71

Intervention details	Identified issues Differences in neuromuscular improvement, gait and balance improvement, quality of life and risk factors management in patients who undergo stationary inpatient rehabilitation in comparison with patients who undergo rehabilitation at home.
	Aim The main aim study is to compare the effect of inpatient stationary rehabilitation with rehabilitation at home on functional improvement of stroke patients (function of the upper limbs, lower limbs and balance). The first hypothesis is that inpatient stationary rehabilitation will lead to a statistically significant improvement in neuromuscular function, with these effects being statistically significantly greater than those induced by home rehabilitation. The second hypothesis is that inpatient therapy will produce a statistically significant improvement in quality of life, with these effects being statistically significantly greater than those induced by home rehabilitation.
	Description Before intervention initiation, the patient were assessed regarding risk factors (blood pressure, medical history about cardiovascular diseases, smoking, stress, alcohol consumption, physical inactivity, ECG, blood glucose and lipid profile, body mass index) Initial assessment (after acute hospital treatment) and final assessment (after 3 weeks of rehabilitation) included: 1) upper limb motor function assessment with Oxford scale 2) balance function according to Berg balance scale (BBS) 3) gait function according to Timed Up and Go Test (TUG) 4) quality of life scale according to health survey Short form 36 (SF 36) Stationary rehabilitation in a special hospital for medical rehabilitation includes a physicians examination at admission and release from hospital, the following physical-rehabilitation procedures: kinesitherapy, electrotherapy, hydrotherapy, medical care and thermal pools, during 3 weeks. Rehabilitation at home includes the arrival of a physiotherapist at the patient's home, individual exercises, stretching, joint mobilization and massages.
	Results 1. Stationary rehabilitation was shown to be more effective in female stroke survivors, while rehabilitation in home led to a significant improvement in neuromuscular function in male stroke survivors. 2. Stationary rehabilitation was superior in quality of life improvement, with better effect in female stroke survivors. 3. There were some gender differences: when assessing the total functional outcome, stationary rehabilitation seems to

	be more effective in female stroke survivors, while home rehabilitation seems to be more effective in male stroke survivors. 4. The results show that the improvement of the upper limb and balance in female stroke survivors was significantly better in stationary rehabilitation in comparison with home rehabilitation– with the same cost of treatment, while the same effect was not observed in male stroke survivors. 5. The total functional outcome depends also on the comorbidities and risk factors of each patient, and the treatment of those comorbidities is better regulated in patients in stationary rehabilitation, thus decreasing the risk of a recurrent stroke and reducing the cost of treatment.
	Strengths of the intervention, Weaknesses of the intervention, Conclusions, Recommendations, Special features Strenghts include an individualized approach, assessible and easy to use outcome measures, good results. Weaknesses include small sample size, short follow up. Taking in account all the results, the conclusion of the intervention would be that an individual approach to every stroke patient, with the evaluation of risk factors, comorbidities, socioeconomic situation, age and gender, would enable the most appropriate rehabilitation modality with the best cost-effectiveness. It seems to be very important above all to rehabilitate motor function and visuospatial functions first (total NIHSS score), as a prerequisite to improve gait and balance (assessed by Timed up and go test and Berg balance scale).
Measurement	Across time (were the results compared with pre-intervention periods?) Yes. Across place (were the results compared with another setting?) Yes. Across a comparison group (in the same institution) Yes.
Publicity	Has the intervention been presented or published? Yes, as a doctoral thesis. Filipović B. DIFFERENCES IN FUNCTIONAL RECOVERY AND QUALITY OF LIFE OF PATIENTS WITH STROKE BETWEEN STATIONARY AND HOME REHABILITATION. [Doctoral thesis]. Zagreb: University of Zagreb, Faculty of Kinesiology; 2015. Available at: https://urn.nsk.hr/urn:nbn:hr:117:447858

Title	**Rehabilitation of patients with hand function impairment by mirror-induced visual illusion**
Basic details	Beginning / end of intervention (dates) Year 2016., intervention during a period of 10 days of inpatient rehabilitation
	Place of intervention Special Hospital for medical rehabilitation Varazdinske toplice
Patients' characteristics	Type of stroke Ischemic and hemorrhagic, patients with both right and left hemiparesis equally distributed in the experimental and control group
	Intervention group size 31 patients in total, 17 patients in the experimental group
	Gender (%males) N/A
	Mean age N/A
Intervention details	Identified issues The visual illusion of movement using a mirror is used to improve the motor function of the impaired limb after a stroke. The patient observes the reflection of his healthy hand with which he performs movements in the mirror, imagining that it is the impaired hand and thus stimulates and activates neural networks in which movements are stored, using the brain's neuroplasticity for motor recovery, to improve activity and function.
	Aim The aim of this intervention is to assess the effect of mirror therapy for the improvement of arm dexterity, compared to standard rehabilitation modalities.
	Description Stroke patients hospitalized in the Special hospital for medical rehabilitation were randomized into two groups: the experimental group underwent standard rehabilitation treatment with additional mirror therapy, once a day, 5 days per week; the control group underwent the standard rehabilitation treatment, including the usual physiotherapy procedures, occupational therapy and multidisciplinary team care. Both groups consisted of an equal number of patients with right sided and left sided hemiparesis. The team consisted of the patient, the physiatrist and the physical/occupational therapist. Exercises were conducted for 15 minutes per day, divided into three series of 5 minutes. The assessment of hand function was done before treatment start, and after the 10^{th} day of treatment. The Core Upper Limb scale (CUL) was used to assess for reach, speed, precision of movements and task performance.
	Results The mean score of the CULscale in the experimental group was 30, while the CUL score in the control group was 14 (p=0,018). The results show the efficacy of mirror therapy in the improvement of motor function in the upper limb in this population of patients,

	leading to a greater potential of self-care and activities of daily living.
	Strengths of the intervention, Weaknesses of the intervention, Conclusions, Recommendations, Special features Strenghts: effectiveness, no complications or side-effects, good cost-benefit ratio, high compliance. Weaknesses: small sample size, randomization process not clear, short intervention period and short follow up period. If confirmed with additional studies, it could be an addition to the standard rehabilitation modalities.
Measurement	Across time (were the results compared with pre-intervention periods?) Yes Across place (were the results compared with another setting?) No Across a comparison group (in the same institution) Yes
Publicity	Has the intervention been presented or published? Yes Orbanić I, Moslavac S, Moslavac A, Lohman Vuga K, Tomičić S, Bene R et al. Rehabilitacija pacijenata s funkcijskim oštećenjem šake pomoću zrcalne vizualne iluzije. Fizikalna i rehabilitacijska medicina [Internet]. 2017. Available at: https://hrcak.srce.hr/234899

Czech Republic

Title	**Robotic Rehabilitation of the Hand Spasticity/ Robotická rehabilitace spasticity ruky**
Basic details	Beginning / end of intervention (dates): Study does not specify
	Place of intervention: Physiotherapy FZV UP, Olomouc, Neurologická klinika LF UP, Olomouc
Patients' characteristics	Type of stroke: Study does not specify the type.
	Intervention group size: 20 pers experimental, 18 control gr.
	Gender (%males) experimental group 45% male, 55% female, control group 50%/50%
	Mean age: 60
Intervention details	Identified issues: None.
	Aim: The aim of the study is to control the effect of robotic therapies in patients after a stroke (6-60 months after onset) with spastic hand paresis with those according to the modified Ashworth scale (MAS) 1-3
	Description: The study aimed at verification of the effects of robotic therapy in patients after brain vascular event (6 to 60 months after the origin) wit spastic hand paresis in a degree according to modified Ashworth scale (MAS) 1 – 3. The prospective randomized study of 20 cases and 18 controls evaluates the changes in the grip by the SVH test (score of visual evaluation of hand grip strength test) and changes in finger spasticity after eight weeks of treatment. The experimental group underwent a complex antispastic therapy (administration of botulinum toxin, 300 Speywood units

	Dysport botox – fractionated into the surface and deep flexor of fingers, physiotherapy for 5 hours weekly and ergotherapy 2.5 hour weekly). The control group was treated by the conventional complex therapy.
	Results: In the experimental group there were statistically significant changes in diminution of spasticity (MAS median form 2 to 1 in the experimental group versus 2 to 1+ in the control group) and an improvement in the hand grip functions (SVH from median of 10 entry to 15 on the output in the experimental group against SVH in median 11 to 13). However, the results were not significant at the P=0.05 level.
	Conclusions: The robotic rehabilitation has an important influence in antispastic treatment of fingers with perspective therapeutic results, as our study has shown.
Measurement	Across time (were the results compared with pre-intervention periods?) Yes, they carried out some pre-intervention assessment for the comparison of the data. Across place (were the results compared with another setting?) No, they weren't. Across a comparison group (in the same institution): Yes.
Publicity	Has the intervention been presented or published? Yes, it has been published. https://www.prolekare.cz/casopisy/rehabilitace-fyzikalni-lekarstvi/2017-1/roboticka-rehabilitace-spasticity-ruky-60477/download?hl=cs

Title	**The Involvement of the Amadeo Instrument into a Standard Therapy in Patients after Brain Vascular Event in the Chronic Phase: A Follow up Study**
Basic details	Start and the end is unknown
	Clinic of Rehabilitation Medicine of General Hospital in Prague
Patients' characteristics	HemorRagic (1) and Ischemic (11) type of stroke, chronic phase
	12 clients
	Gender: 50% males
	Mean age: 67,5
Intervention details	None issues were described, some patients wasn´t improving in more difficult test´s probably because of the complexity.
	The aim of this follow-up study was to demonstrate the sustainability of intensive therapy on the Amadeo device and after a month from the end of therapy.
	Description: Before starting the exercise on AMADEO. The therapist will do a stretching of the spastic muscles of the upper acre extremities. This was followed by intense training

	using an Amadeo for 45 minutes. The first 5-20 minutes were devoted to the passive exercises (CPM and CPMplus), which alternated with assisted exercise, then active training - games Balloon, Firefighter, Recycling, Apple Picker, Shootout
	Results: The improvement and sustainability was tested by the standardized test for maintaining motor functions of upper extremity, hand grip strength, motion range of fingers before and after a series of treatments (one month, three times weekly) and then again after a month since the intensive treatment ended. No statistically significant improvement had been identified.
	Strengths of the intervention: specific measurements, intensive treatment, Weaknesses of the intervention: not enough evidence based, the need of fine motor skills, short time intervention
Measurement	Across time Yes, by many tests (Jebsen Taylor Hand Function test, Jamar Dynamometer, Goniometry for testing the range of motion of fingers before and after the series of therapy, Modified Ashwort Scale) Across place: No Across a comparison group: No
Publicity	Has the intervention been presented or published? Yes in a journal https://www.prolekare.cz/casopisy/rehabilitace-fyzikalni-lekarstvi/2017-1/zapojeni-pristroje-amadeo-do-standardni-terapie-u-pacientu-po-cevni-mozkove-prihode-v-chronicke-fazi-follow-up-studie-60478

Greece

Title	Cervical isometric exercises improve dysphagia and cervical spine malalignment following stroke with hemiparesis: a randomized controlled trial (Ploumis et al, 2018)
Basic details	Beginning / end of intervention (dates): October 2012 - May 2014
	Place of intervention: Physical Medicine and Rehabilitation Department of the University Hospital of Ioannina, Ioannina, Greece
Patients' characteristics	Type of stroke: Patients with hemiparesis following stroke and symptoms of dysphagia
	Intervention group size: 37
	Gender (%males): 75,7% males
	Mean age: 52±15 years
Intervention details	Identified issues: None
	Aim: To evaluate the use of cervical isometric exercises in

	dysphagic adult patients with cervical spine alignment disorders due to hemiparesis after stroke.
	Description: In addition to the standard physical and speech therapy therapeutic approach for 12 weeks, cervical isometric exercises were conducted by a group of patients (experimental group). Patients had cervical spine radiographs in erect (sitting or standing) position coronal and sagittal C2-C7 Cobb angle and a videofluoroscopic swallowing study to evaluate deglutition at 2 time points (at the beginning and at the end of the therapeutic program). The cervical isometric exercises were carried out in all 4 directions (by placing their hand or their personal assistant's hand on their head and contract their neck muscles under resistance forward-backward-sidewards) four repetitions for 10 minutes three times a day for 12 consecutive weeks. Neck muscles that were contracted included in general the cervical spine flexors-extensors-lateral flexors-rotators. These exercises were performed initially (for the first 1-2 weeks) both in the lying and sitting position but thereafter in the sitting position. All of the participants were in need of their assistant to complete these exercises. It was imperative that during the exercises the patients did not experience pain or any other negative feeling.
	Results: Patients improved cervical alignment, in both coronal and sagittal plane, and deglutition. Patients who conducted cervical isometric exercises (experimental group) had more pronounced correction of cervical alignment in both planes and achieved greater improvement of deglutition too, than patients who did not conduct such exercises (control group).
	Strengths of the intervention, Weaknesses of the intervention, Conclusions, Recommendations, Special features: Dysphagic adult patients with hemiparesis after stroke in the rehabilitation phase who underwent cervical isometric strengthening exercises showed more significant correction of cervical alignment and more pronounced improvement in deglutition compared to patients who did not include cervical isometric exercises in their therapeutic program. The additional use of cervical isometric exercises in hemiparetic stroke patients with dysphagic symptoms lead to more pronounced improvement of their swallowing function compared to such patients who are subjected to speech therapy only. Furthermore, these exercises are shown to be beneficial for cervical spine alignment too. Limitations of this study rest on the number of patients.
Measurement	Across time (were the results compared with pre-intervention periods?) Yes, at the beginning and at the end of the therapeutic program Across place (were the results compared with another setting?) No Across a comparison group (in the same institution) Yes, 33 patients as control group

Publicity	Has the intervention been presented or published? Yes https://www.minervamedica.it/en/journals/europa-medicophysica/article.php?cod=R33Y2018N06A0845

Title	The Value of Exercise Rehabilitation Program Accompanied by Experiential Music for Recovery of Cognitive and Motor Skills in Stroke Patients (Fotakopoulos & Kotlia, 2019)
Basic details	Beginning / end of intervention (dates): 2017-2018 (6 months)
	Place of intervention: Rehabilitation center in University Hospital of Larissa, Larissa, Greece
Patients' characteristics	Type of stroke: Acute ischemic or hemorrhagic stroke
	Intervention group size: 24
	Gender (%males): 58.3%
	Mean age: 73.29 ± 4 years
Intervention details	Identified issues: Since, the quality of rehabilitation interventions must be improved in addition to their quantity, it is important to predict the prognosis for stroke. In order to predict the prognosis for these patients at the start of rehabilitation, therapists should be able to evaluate associated factors using simple assessment tools.
	Aim: To assess the effects of exercise rehabilitation program accompanied by experiential music for clinical recovery
	Description: Patients followed a 6 months music-based exercise program, at a frequency of 4 training sessions per week, for 45 minutes each session. Each training session included Group activities supported by experiential/traditional music throughout each lesson, with a 5 minutes warm-up period of breathing and flexibility exercises followed by the main part of upper and lower body strengthening, balance and co-ordination exercises on sitting and standing position and trunk movements performed at a moderate intensity and a cool-down period of 5-10 minutes of patients holding hands while moving slowly in a circle listening to music.
	Results: Recovery rate (defined as the improvement of cognitive and motor skills of the limb in the affected site, with an increase of muscle strength at least by 1/5 and with emotional progress) was higher when exercise rehabilitation program was accompanied by an enriched sound environment with experiential music on stroke patients (in exercise Group [26.2%] compared to control Group [13.8%]).
	Strengths of the intervention, Weaknesses of the intervention, Conclusions, Recommendations, Special features: The music-based exercise program has a positive effect on mood profile in stroke patients and Recovery rate is higher when exercise rehabilitation program was accompanied by an enriched sound environment with experiential music. To improve the quality of rehabilitation interventions, it is

	important to predict the prognosis for stroke. The location in a single rehabilitation center and the not sufficiently examined confounding factors that may have affected the prognosis of stroke survival patients are the main weaknesses of this intervention.
Measurement	Across time (were the results compared with pre-intervention periods?) Yes, at the beginning and at the end of the exercise rehabilitation program Across place (were the results compared with another setting?) No Across a comparison group (in the same institution) Yes, 41 patients as control group
Publicity	Has the intervention been presented or published? Yes https://www.strokejournal.org/article/S1052-3057(18)30348-3/fulltext

Italy

Title	**"EFFECTIVENESS OF ADAPTIVE PHYSICAL ACTIVITY COMBINED WITH THERAPEUTIC PATIENT EDUCATION IN STROKE SURVIVORS AT TWELVE MONTHS: A NON-RANDOMIZED PARALLEL GROUP STUDY." Simona Calugi, Mariangela Taricco, Paola Rucci, Stefania Fugazzaro, Mary Stuart, Laura Dallolio, Paolo Pillastrini, Maria P Fantini, EFG/2009 investigators**
Basic details	November 2009/May 2012
	Emilia Romagna (Italy)
Patients' characteristics	Both ischemic and hemorrhagic stroke
	Intervention group size: 229
	Gender (%males): not available
	Mean age: 71 (±10.6) years
Intervention details	Identified issues
	Aim To evaluate the effectiveness, in both the short and long period of therapeutic patient education (TPE) and Adapted Physical Activity (APA) intervention in stroke survivors, aiming to educate patients towards prevention and self-management of disabling sequelae deriving from this condition.
	Description Physical activity has the dual purpose of maintaining the motor and functional level of subjects with basic neuromotor pathology in the chronic / stabilized phase, through a continuous process of cardiovascular reconditioning and muscle strengthening. Three group sessions of interactive Therapeutic Patient

	Education (TPE) and 8 weeks of twice-weekly Adaptive Physical Activities (APA) exercise sessions have been delivered.
	Results: APA associated to TPE results to be a useful and potentially cost-effective intervention to maintain and improve activities of daily living, reduce fractures and recourse to rehabilitation treatments. It has been observed a significative improvement on mobility, balance and on patients' perception of recovery from the acute phase.
	Strengths of the intervention, Weaknesses of the intervention, Conclusions, Recommendations, Special features: The effects of physical exercise carried out in the 12 weeks program were several, including: • Improvement of mobility • Improvement of balance • Reduction of rehabilitation treatments recourse • Reduction of fractures • Improvement of quality of life The strength of this study is represented by the large sample evaluated at three time points and the long-term follow-up (12 months) allowing to verify intervention effects in the long term.
Measurement	Across time (were the results compared with pre-intervention periods?) yes, patients were evaluated at baseline, at 4 and 12 months. Across place (were the results compared with another setting?) no Across a comparison group (in the same institution) yes, the study compared APA-TPE intervention with treatment as usual (TAU).
Publicity	Has the intervention been presented or published? The intervention has been published as an article: Effectiveness of adaptive physical activity combined with therapeutic patient education in stroke survivors at twelve months: a non-randomized parallel group study." Simona Calugi, Mariangela Taricco, Paola Rucci, Stefania Fugazzaro, Mary Stuart, Laura Dallolio, Paolo Pillastrini, Maria P Fantini, EFG/2009 investigators

Title	**Effects of low-intensity endurance and resistance training on mobility in chronic stroke survivors: a pilot randomized controlled study.** Department of Rehabilitation Medicine of Ferrara University Hospital
Basic details	2013/2015
	Emilia Romagna (Italy)
Patients' characteristics	Both ischemic and hemorrhagic stroke

	Intervention group size: 35
	Gender (%males): 77.14%
	Mean age: 68.4±10.4 years
Intervention details	Identified issues
	Aim To evaluate if an 8-week, community-based, progressive mixed endurance-resistance exercise program at lower cardiovascular and muscular load yielded more mobility benefits than a higher-intensity program in chronic stroke survivors.
	Description 8-week program composed of an endurance phase based on walking training (weeks 1-4) followed by a mixed phase (weeks 5-8) mainly focusing on muscle-strength training.
	Results
	Strengths of the intervention, Weaknesses of the intervention, Conclusions, Recommendations, Special features The effects of physical exercise carried out continuously over time, with the appropriate frequency and intensity, are many: • Improvement of mobility • Improvement of lower-limb strength and power • Improvement of balance • Improvement of gait speed • Improvement of gait quality of life However, this project has some weaknesses represented by the small sample size and the lack of a follow-up measure.
Measurement	Across time (were the results compared with pre-intervention periods?) yes, patients were evaluated at baseline and at the end of the intervention. Across place (were the results compared with another setting?) no Across a comparison group (in the same institution): yes, low-intensity program was compared to a higher-intensity one.
Publicity	Has the intervention been presented or published? The intervention has been published as an article: “Effects of low-intensity endurance and resistance training on mobility in chronic stroke survivors: a pilot randomized controlled study.” Lamberti, N., Straudi, S., Malagoni, A. M., Argirò, M., Felisatti, M., Nardini, E., Zambon, C., Basaglia, N., & Manfredini, F.

Lithuania

Title	**Effects of virtual reality and traditional physiotherapy on patient gait and balance**
Basic details	April 1-30, 2020
	Palanga Rehabilitation Hospital
Patients' characteristics	Type of stroke: Ischemic
	Intervention group size – 8
	Gender (%males) – 50/50
	Mean age – not available
Intervention details	Identified issues – It is expected that the positive changes in functional ability will be higher for the patients who had undergone the head brain stroke by applying the alternative therapy virtual reality method compared to the traditional rehabilitation methods
	Aim – To reveal the effect of virtual reality and traditional physiotherapy on gait and balance
	Description
	Results: 1. The application of PC virtual reality system to the patients who had undergone the head brain stroke, has favoured in achievement of a better results in rehabilitation. This method had a positive influence on patients' balance, coordination (ataxy). Due to activate the cognitive functions and to improve the self-support function, the application of virtual reality method was an efficient method for rehabilitation even the patients who had a low level of self-support functions disorder 2. The patients positively evaluated the new method used for their rehabilitation. Most of them enjoyed the method of virtual therapy by implementing virtual reality system. This method was useful way for the patients to be involved in rehabilitation process.
	Strengths of the intervention, Weaknesses of the intervention, Conclusions, Recommendations, Special features The study revealed that the patients who devoted the least time and willingness to the procedure were also the least motivated patients. The study found that patients who spent the most time on virtual reality therapy procedures during their departure from the rehabilitation center had significantly improved their independence. In order to maintain such motivation for a longer period, it is recommended to train continuously and expand the computer package with new programs
Measurement	Across time (were the results compared with pre-intervention periods?) - NO

	Across place (were the results compared with another setting?) - NO Across a comparison group (in the same institution) - NO
Publicity	Has the intervention been presented or published? NO

Title	**GAIT RECOVERY IN PATIENTS WITH SUBACUTE STROKE APPLYING KINISIFORO (The robotic elliptical gait trainer) SYSTEM**
Basic details	November, 2019
	Palanga Rehabilitation Hospital
Patients' characteristics	Type of stroke N/A
	Intervention group size – 12
	Gender (%males) – N/A
	Mean age – age 55-70 years
Intervention details	Identified issues –different physiotherapy techniques may influence the recovery in patients after stroke
	Aim – To evaluate the effects of different physiotherapy techniques on gait recovery in patients after stroke
	Description 12 first stroke patients (subacute period, age 55-70 years, muscles strength of affected leg, grade ≥ 2–3) who underwent rehabilitation at Palanga Rehabilitation Hospital in 2019, were randomly assigned into two groups. I group received gait training with KinisiForo System; II group - over ground gait training exercises. Duration of research was 3 weeks. Measurements: Manual muscle testing, Postural Assessment Scale for Stroke Patients (PASS), 10 meter walk test (walking speed, gait asymmetry, stride length, step width), Timed "Up and go" test, Berg balance Scale, Wisconsin Gait Scale for assessment of hemiplegic gait.
	Results: After 3 weeks of training with KinisiForo the strength of ankle plantar flexion muscles showed more changes than after over ground gait training. Among the group I, participants strength of the ankle plantar flexion muscles on the affected side showed an increase of 1.0 score (according Lovett scale) and reached grade -4.5 scores. Analyzing results according to PASS scale a bigger improvement in trunk control was found after training with KinisiForo. Group I also showed bigger changes in stride length, gait asymmetry and walking speed (m/s). After applying KinisiForo stride length increased approximately by 38 cm (in group II the increase was smaller - 18 cm). Analyzing the Group 10-meter walk test data, we found a double increase in walking speed in group I. It changed from 0.31 (m/s) to 0,66 (m/s) after 3 weeks of

	physiotherapy with KinisiForo. Walking speed in group II also improved with a change of 0.22 m/s. Summing „Up & Go“ test results between groups, group I patients showed a bigger change in task performance speed-time decreased by about 20 s. Group II patients showed less improvement – 15 s. Berg's balance scale changes between groups differ less. After gait training with KinisiForo Berg‘s test results improved by 16 points, applying gait training exercises - 12 points.
	Strengths of the intervention, Weaknesses of the intervention, Conclusions, Recommendations, Special features Results have shown that after gait training with KinisiForo patients experienced a bigger improvement in gait. End-effector type robot-assisted gait training systems strongly influence changes in propulsion generation during gate cycle. The principle of elliptical motion insures better trunk control and influences change in gait symmetry. The above mentioned factors strongly influence change in walking speed.
Measurement	Across time (were the results compared with pre-intervention periods?) - NO Across place (were the results compared with another setting?) - NO Across a comparison group (in the same institution) - NO
Publicity	Has the intervention been presented or published? NO