

International Journal of Impact Engineering. 2013;62:142-51. doi: <https://doi.org/10.1016/j.ijimpeng.2013.07.002>

27. Wang Y, Shi X, Chen A, Xu C. The experimental and numerical investigation of pistol bullet penetrating soft tissue simulant. Forensic Sci Int. 2015;249:271-9. doi: <https://doi.org/10.1016/j.forsciint.2015.02.013>

28. Gilson L, Rabet L, Imad A, Coghe F. Experimental and numerical characterisation of rheological properties of a drop test response of a ballistic plastilina. Forensic Sci Int. 2020;310:110238. doi: <https://doi.org/10.1016/j.forsciint.2020.110238>

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## THE BENEFITS OF COORDINATED REHABILITATION IN THE TREATMENT OF STROKE PATIENTS: A LITERATURE REVIEW

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**Abstract.** **The benefits of coordinated rehabilitation in the treatment of stroke patients: A literature review.** Shuranova L., Vacková J., Míková M. The article reveals the features of coordinated rehabilitation – a process that leads to rehabilitating of people with neurological damage that limits their functionality. The purpose of the article is a literature review within the framework of GAJU 066/2022/S, funded by the grant agency of the South Bohemian University of Czech Budejovice, Czech Republic, examining the effectiveness of coordinated rehabilitation in patients recovering from strokes and the use of the standardized Functional Independence Measure (FIM) test to assess the patient's condition. Data come from current Czech and foreign publications. The EDS multi-finder was used to search for literary sources. Document searches were from 2016-2022 in Czech and English. Search terms include post-stroke rehabilitation,

*FIM, rehabilitation after stroke, neurorehabilitation, and community based rehabilitation. The start of coordinated rehabilitation of stroke patients should be timely, long-term, comprehensive, and effective, involving a multidisciplinary approach and teamwork. It is essential to develop an individual approach and create a suitable individual plan that allows the use of the FIM test. This is the only way to establish long-term and mutually beneficial cooperation. As the cost of rehabilitation increases, the financial burden on the healthcare system also increases. Caring for a stroke patient also puts various burdens on the family. Successful rehabilitation can reduce the use of costly medicines and materials and decrease the need for nursing care and the term of hospital stay. The social costs of strokes are associated with long-term dependence and a low degree of resocialization. Considering the frequency of strokes and the associated disability, there is an increasing need for coordinated services within coordinated rehabilitation. Gaps in data on coordinated stroke rehabilitation should be filled by providing necessary information about long-term participation in community-based programs.*

**Реферат. Переваги координованої реабілітації в лікуванні хворих після інсульту. Літературний огляд. Шуранова Л., Вацкова Й., Мікова М.** У статті розкриваються особливості координованої реабілітації, що є процесом, який веде до реабілітації людей з неврологічними ушкодженнями, що обмежують їхні функціональні можливості. Мета статті – огляд літератури в рамках проекту GAJU 066/2022/S, фінансованим грантовою агентурою Південночеського університету, Ческе-Будейовице, Чеська Республіка, щодо ефективності застосування координованої реабілітації в пацієнтів, які одужують після інсульту, та використання стандартизованого тесту Функціонального ступеня незалежності (FIM) для оцінки стану пацієнта. Дані були взяті з актуальних чеських та закордонних публікацій. Для пошуку літературних джерел використовувався мультишукач у базах за період 2016-2022 років чеською та англійською мовами. Пошукові терміни: післяінсультна реабілітація, FIM, реабілітація після інсульту, нейрореабілітація, реабілітація на рівні муніципалітетів. Визначено, що злагоджена реабілітація хворих після інсульту має бути своєчасною, довготривалою, комплексною та ефективною, включати мультидисциплінарний підхід та командну роботу. Дуже важливо розробити індивідуальний підхід і скласти відповідний індивідуальний план, який дозволить нам зробити тест FIM. Наголошено, що тільки таким чином можна налагодити довгострокову та взаємовигідну співпрацю у всіх сферах. Оскільки вартість реабілітації зростає, фінансове навантаження на країну також зростає. Догляд за хворим після інсульту лягає тягарем на його родину. У висновку наголошується на тому, що успішна реабілітація може привести до зниження вартості ліків і матеріалів та зменшення потреби в догляді, а також загального перебування в лікарні. Вплив на зменшення соціальних витрат, пов'язаних з довготривалою залежністю та низьким ступенем ресоціалізації, також може бути дуже значним. У зв'язку з поширенням інсульту та інвалідності внаслідок нього, зростає потреба в координованих послугах у рамках координованої реабілітації. Наголошується на тому, що прогалина в даних про координовану реабілітацію після інсульту повинна бути заповнена наданням важливої інформації про довгострокову участь громади.

One of the main targets of the World Health Organization (WHO) is to reduce the mortality of noncommunicable diseases, which includes stroke. Coordinated rehabilitation is one primary means of helping stroke patients return to their former life.

In 2019 the WHO estimated that stroke was the second leading cause of death, with 6.7 million stroke deaths, accounting for 11.9% of all deaths globally [1]. According to the WHO, stroke is third in the world in terms of causing disability [1]. In the Czech Republic, stroke ranks second in mortality, with 74.77 deaths per 100,000 people [1].

Strokes create severe economic burdens for national and private healthcare systems. According to the VZP data (VZP is the largest health insurance company in the Czech Republic (CZ)) as of 27 OCT 2021, 2,190,275 Czech crowns (1 USD  $\cong$  24 Czech crowns (Koruna)) were spent in 2020 on strokes [2]. VoZP (VoZP is the Military Health Insurance Company of the CZ) spent 208 million Czech crowns in 2019 on strokes [3]. These figures do not include post-discharge stroke-related costs, further rehabilitation, or additional care.

The treatment of stroke patients is evolving, and new protocols, treatments, and care methods are emerging. However, the availability and timeliness of treatment, rehabilitation, and coordination of individual elements of care vary from region to region, which, in turn, can lead to irreversible consequences for the patient.

The problems faced by the professionals involved in treating, monitoring, caring for, and rehabilitating stroke patients are apparent. Firstly, coordinated rehabilitation is not clearly defined in the Czech Ministry of Health bulletin [4], i.e., there are no clearly defined deadlines for each step in the process. Additionally, there are no explicit guidelines for creating individualized treatment plans for stroke patients. Currently, the Czech Republic is collecting data on stroke patients through the RES-Q platform [5].

RES-Q is a worldwide platform for monitoring stroke patients [5]. Experts developed this registry at the International Center for Clinical Research at St. Anne's University Hospital in Brno, CZ to improve the quality of care for stroke patients. The platform provides an easy way for hospitals to monitor their

stroke care processes, i.e., by comparing outcomes and fine-tuning to improve the quality of care. The tool also allows hospitals to collect key performance indicators related to the quality of stroke patient care based on internationally recognized practices. It is also a platform for monitoring outcomes and viewing up-to-date hospital performance [5].

The problem with assessing patients is not only the availability of rehabilitation itself but also the fact that some patients go straight home after discharge from the neurological unit while others go straight into the long-term care unit. Thus, they disappear from view because there are no clearly defined criteria for stroke patients to be under the care of one or more specialists. Additionally, there is no explicit coordination among teams of specialists who examine and treat patients. Although in decree n. 39/2012 Sb. o dispensary care – wording from 1 May 2021 in point 55 of the appendix, for family doctors, dispensary care was introduced after a stroke [4].

A standardized tool (test) is needed to assess rehabilitation effectiveness. Such a tool would allow the patient's condition to be assessed in the intensive care and rehabilitation unit and at home. There is a need for guidance on how to approach patients after a stroke in terms of coordinated rehabilitation, i.e., for patients and general practitioners and possibly for rehabilitation specialists in hospitals.

The above mentioned formed the basis for a research project funded by the University of South Bohemia in České Budějovice called “Coordinated rehabilitation and its continuity after hospital discharge” (project number GAJU 066/2022/S, duration 1 Feb. 2022 to 31 Dec. 2023).

The purpose of this article is to provide a literature review within the framework of GAJU project 066/2022/S on the effectiveness of coordinated rehabilitation in stroke patients, using the standardized FIM test to assess the patient's condition.

#### *Data sources*

We searched several databases (Medline, Scopus, PubMed, Web of Science) for relevant original texts and articles. The search strategy included the words: “Post-Stroke Rehabilitation” and “FIM” or “Rehabilitation after Stroke,” “FIM” or “neurorehabilitation,” and “FIM,” “Community Based Rehabilitation. We used Medvik to search the Czech and Slovenian sources. The search strategy included words (Boolean operators): “koordinovaná rehabilitace,” “FIM,” “cévní mozková příhoda,” “neurorehabilitace.” The period was from 1 Jan. 2016 to 31 Sept. 2022 in English, Czech, or Slovak.

Stroke is one of the leading causes of death and disability worldwide. Since 2004, the WHO has declared stroke a global epidemic. The WHO developed

the disability-adjusted life year [6] (DALY) indicator to measure, compare, and analyze the burden of various diseases, and it is well suited to stroke research. The DALY combines the time lost through premature death and disability. Measuring each patient's stroke outcome with the loss of DALYs has broadened its application to treatment effect analysis in acute stroke trials, determining the impact of post-stroke complications, differential weighting of discrete vascular events, and estimating a more accurate burden of stroke in a specific population.

The World Stroke Organization (WSO) published the Global Stroke Bulletin in 2022 by Lindsay et al. [7]. The estimated global cost of stroke is \$721 billion (0.66% of global GDP) [7]. According to the organization, the burden (in terms of the absolute number of cases) increased significantly from 1990 to 2019 (70.0% increase in stroke cases, 43.0% increase in stroke deaths, 102.0% increase in stroke prevalence, and 143.0% increase in DALYs), with the majority of the stroke burden (86.0% deaths and 89.0% DALYs) falling on low and lower-middle-income countries (LMICs) [7].

According to a statistical analysis by Thrift et al. [8], despite stable incidence rates and declining mortality rates over the past two decades, the number of stroke cases, stroke survivor prevalence, DALY lost due to stroke, and stroke-related deaths are increasing.

The results of the Global Stroke Statistics 2019 Review by Kim et al. [9] concluded that current statistics on stroke incidence and mortality show differences between countries and differential burdens among high-, low-, and middle-income countries. Reporting from hospital stroke units remains limited and should be encouraged [9].

In 2016, the team of authors [10] presented the “Global, regional, and national burden of stroke, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016,” according to which the number of new stroke cases rose to 13.7 million in 2016. Furthermore, the team of authors [10] reported that 5.5 million deaths worldwide were stroke-related in the same year.

Stroke is often a severe and debilitating condition requiring ongoing rehabilitation. Dunbar et al. [11] predicted that between 2015 and 2035, the estimated total direct medical costs associated with stroke would more than double, from \$36.7 billion to \$94.3 billion.

According to Angerova et al. in 2020 [12], there are currently 13 integrated cerebrovascular centers (comprising neurosurgery, radiology, neurology, and an early rehabilitation unit) and 32 stroke centers (neurology and early rehabilitation unit) in the Czech Republic. Thus, patients are usually transferred to early rehabilitation units between 7 and 14 days after

a stroke, where they receive 3-4 hours of multidisciplinary rehabilitation per day [12].

In 2017, the WHO launched “Rehabilitation 2030: a call for action” by Gimigliano et al. [13] to draw attention to the increasing unmet needs for rehabilitation. The program’s core principles are the global need for rehabilitation, improved access to rehabilitation, and building and strengthening rehabilitation networks and partnerships, particularly among low-, middle- and high-income countries, to help reduce disabling diseases [13].

Coordinated rehabilitation is an essential part of reducing disability after a stroke. According to Švestkové [14], coordinated rehabilitation is a continuous and comprehensive activity that alleviates, as far as possible, the direct consequences of long-term adverse health conditions that limit or prevent social reintegration. Švestkové [14] lists timeliness, continuity, coordination, synergy, and accessibility as the main characteristics of coordinated rehabilitation.

According to Vacková et al. [14], coordinated rehabilitation refers to multidisciplinary teamwork, in a home environment, after the patient is discharged from the hospital. It is worth highlighting that the term coordinated rehabilitation is similar to Community-Based Rehabilitation (CMB).

Ru et al. [15] evaluated the effectiveness of a post-stroke program based on CMB techniques to improve the functional recovery of stroke survivors. It is worth noting that in their results Ru et al. [15] emphasized that CMB improves motor function, activities of daily living, and social functioning in stroke survivors.

According to the “Guidelines for Adult Stroke Rehabilitation and Recovery” from the American Heart Association/American Stroke Association [16], stroke rehabilitation requires constant team coordination. This includes the patient and his/her family or caregivers, doctors, physiotherapists (physical therapists), psychologists, social workers, and others. The recommendation is that the whole team work in a coordinated and coherent way to maximize rehabilitation effectiveness. However, without communication between team members, the individual components of coordinated rehabilitation are unlikely to produce the expected outcomes.

The primary principle underlying stroke rehabilitation is increased patient autonomy. This can be achieved by early, comprehensive, and fully coordinated action of all team members.

Minor et al. [17] conducted a study to determine a plan of rehabilitation on discharge from unit after stroke that could predict activity limitation. The retrograde study by Minor et al. [17] involved patients aged 18-80 years after a mild stroke and without significant cognitive or motor impairment. The

authors used the FIM test in to gether with other tests to create a rehabilitation plan and a follow-up visit after six months. Minor et al. [17] state that standardized discharge measures may predict future limitations.

The Functional Independence Measure (FIM) scale assesses physical and cognitive disability by Lippert-Gruner [18]. This scale focuses on the burden of care, i.e., the level of disability, which indicates the burden of caring for them. The FIM assesses six functional areas (self-care, sphincter control, transfer, movement, communication, and social cognition) that fall under two domains (motor and cognitive). The FIM test makes it possible to document the biopsychosocial functional status of patients. The use of the FIM test is quite simple, but it requires an educational course and the purchase of a license from the Uniform Data System for Medical Rehabilitation (UDSMR).

Ng et al., 2016 [19] published a five-year prospective cohort study in which they observed patients with a recurrent stroke who were either initially admitted directly to the rehabilitation unit or initially admitted to the hospital. The authors used the FIM test to measure functional outcomes to quantify the difference in scores on admission and discharge. The effectiveness of the FIM was measured relative to the recovery percentage.

Valach and Selz, in their article “Rehabilitation programs monitored by the Functional Independence Measure: an observational study” [20], used the FIM test at the Bürger Hospital Rehabilitation Center in Solothurn, Switzerland, as part of sustainable development and quality maintenance. According to the authors, while the use of the FIM in stroke rehabilitation is well documented, its use with other rehabilitation patients is less common [20].

In a similar study, Langhammer et al. [21] measured alternatively FIM on admission, after 18-22 days of rehabilitation, at discharge, and 6- and 12-months post-discharge. The authors [21] showed that the organization of stroke specialist rehabilitation services significantly improves activities of daily living (ADL). The main positive predictors were teamwork patterns, with the multidisciplinary model being the most helpful. Negative predictors were initial severity and disability after stroke.

Li et al. [22] investigated factors that ‘predict’ stroke survivors who may achieve ‘clinically significant functional improvement’ and return home after discharge from a local hospital after utilizing an inpatient stroke rehabilitation program. The study included 562 patients from four different hospitals. The FIM test was used to measure motor improvements. The results of the study supported other previous studies and provided some interesting new findings. Early prediction of stroke outcomes before

discharge helps rehabilitation professionals and occupational therapists focus on the best intervention strategies and to better prepare for discharge [22].

In 2020, Boissoneault C. et al. [23] implemented an intensive rehabilitation program for post-stroke patients aimed at eliminating impairments of mobility dysfunction. The FIM was used to record statistically significant improvements across a range of impairments in functional mobility.

Duncan et al. [24] looked at identifying models of care to improve recovery, independence, and quality of life, which is crucial for stroke survivors and their caregivers. The Comprehensive Acute Stroke Services Study (COMPASS) is an ongoing cluster-randomized, pragmatic study to assess the effectiveness of a comprehensive treatment of acute stroke [24]. This trial addresses a critical gap in care after acute stroke on patient-centered outcomes [24]. An individualized COMPASS Care Plan™, integrated with a community-specific resource database, and additional follow-up visits 30 and 60 days after discharge [24].

Kovářová et al. [25] emphasized that comprehensive patient follow-ups after a stroke are essential. Despite adequate primary and secondary prevention measures, the consequences of acute treatment of patients remain serious. Within three months after a stroke, 10-20% of patients die, 30-40% remain permanently disabled, and 50% achieve total self-sufficiency [25]. Community-based rehabilitation appropriate technique increases rehabilitation participation rates and enhances motor function, daily activity, and social activity of stroke survivors by Ru et al. [26].

It should be noted that the degree of rehabilitation received by people with neurological diseases living in a community setting varies greatly [27]. Saumur T.M. et al. point out that with such a wide range of rehabilitation times, it is likely that the amount of community-based rehabilitation received by most people is not sufficient to improve function and quality of life. In this context, further work is needed to identify barriers to access community-based rehabilitation resources and the amount of rehabilitation needed for functional improvement [27].

Coordinated rehabilitation after a stroke is a long-term process. Patients and their families depend on social support. One good example is the Bochum College of Public Health and the German Stroke Foundation volunteer-supported model “Trained Stroke Assistants – a partnership model for local care (GeSa)” [28].

Bilda K et al. present the results of a pilot study and standardized process for a regional stroke project and describe experiences from the previous project course. The authors suggest that aides can offer patient-centered care and individualized assistance in

everyday life of stroke patients and thus contribute to an improved quality of life. The experience with the project so far has been consistently positive [28].

According to a paper from the German Stroke Society on post-stroke care: Part 1: Long-term care after stroke: the status quo reality and the care gap in Germany – currently, the focus of patient management is on GP care, but without closer and coordinated integration of neurologists in the future it will be more difficult to implement follow-up care based on guidelines and quality control by Bilda et al. [29]. According to the German Stroke Society’s position, there is no distribution of responsibilities and no standards for specialist team training to meet the guidelines [29]. Attention has been drawn to the fact that in addition to medical, physical, and social health, emotional needs must also be addressed; however, emotional needs are seldom considered by multidisciplinary care teams. Further developments in the regional concept of care management are currently being discussed [29].

According to Akhtar N et al. [30], lack of information about rehabilitation was the most common patient-related aspect, and lack of support from caregivers was the most common external factor.

New challenges move towards new solutions – Hirota et al. [31] propose a system for simple home FIM score estimation based on angular velocities measured for specific body movements performed only once, using gyroscopic sensors. In their study, the authors focused on the motor FIM score (mFIM) and whether the optimal specific body movement should be “getting out of bed” or “moving from sitting to standing.” As part of the study, the authors built a model to account for differences in the rate of convergence of movements between healthy subjects and stroke patients. As a result, mFIM scores were estimated by regression analysis with the parameters used in the developed model as explanatory variables and mFIM scores estimated by experienced nurses as objective variables. In the experiments, the mean absolute error of the angular velocity in the spinal direction for rising from the bed was the smallest (9.53) [31].

As noted by Tyagi S et al. [32], in six months post-stroke, approximately 65% of stroke survivors are still unable to engage in everyday activities, which leaves them heavily dependent on others. Of particular importance is research that aims to assess the overall outcome of psychological and physical well-being, increased residual abilities, reintegration, and social integration for people with chronic impairment as a result of stroke after home rehabilitation [32]. Tyagi S. et al. [32] emphasized that a territorial rehabilitation system should address several fundamental aspects, i.e., the centrality of

the individual, the definition of a specific and personalized rehabilitation plan and prognosis based on the results of the dispensary supervision, multi-disciplinary team; highlighting emerging needs; and coordination of different care pathways.

The European Stroke Organization (ESO) prepared the European Stroke Action Plan (ESAP) 2018-2030 in collaboration with the European Stroke Alliance (SAFE) by Norrving et al. [33]. According to the plan, four main goals for 2030 have been identified [33], one of which is to have national stroke care plans covering the entire care chain.

#### Conclusion

In response to healthcare reform efforts, post-stroke care and rehabilitation are often seen as costly areas of care that need to be reduced. However, these cost-reducing efforts fail to recognize the clinical impact or the increased risk of medical morbidity through immobility, depression, loss of autonomy, and reduced functional independence. The provision of comprehensive rehabilitation programs with adequate resources and duration is an important aspect of stroke treatment and should be a modernization priority.

One of the ways of demonstrating the effectiveness of stroke rehabilitation is the FIM test, which can mathematically and graphically show the effectiveness of physiotherapy. It is also possible to use these data in subsequent patient examinations to evaluate the effectiveness or ineffectiveness of the rehabilitation.

The concept of coordinated rehabilitation is well-developed, and we have many excellent examples of its effectiveness. However, due to its complicated implementation in Czech practice, we lack comprehensive data, which would retrospectively help to create clear criteria for financing and legislation.

The Czech Republic is one of the world's leaders in acute stroke care, but the rehabilitation of patients after a stroke is not coordinated and does not use long-term rehabilitation plans, i.e., there is no coordination of services necessary for returning the patient to his/her pre-stroke life.

The results of this project will fill the gap associated with coordinated stroke rehabilitation by providing vital information on long-term community involvement. It includes the creation and publication, as part of the project, "Guidelines on the approach to patients/clients after stroke from the perspective of coordinated rehabilitation," i.e., for patients, general practitioners, and rehabilitation doctors in hospitals.

#### Contributors:

Shuranova L. – conceptualization, investigation, writing – review & editing, visualization;

Vacková J. – supervision, project administration;

Míková M. – supervision, project administration.

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## REFERENCES

1. World Health Organization (WHO). Health statistics and information systems [Internet]. 2015 [cited 2022 Oct 26]. Available from: [https://www.who.int/healthinfo/global\\_burden\\_disease/en](https://www.who.int/healthinfo/global_burden_disease/en)
2. [General Health Insurance Company of the Czech Republic, Main Page General Health Insurance Company of the Czech Republic, main page]. [Internet]. 2022 [cited 2022 Oct 26]. Czech. Available from: <https://www.vzp.cz/o-nas/aktuality/s-mrtvici-se-vloni-lecilo-o-13-mene-klientu-vzp-nez-pred-5-lety-diky-moderni-lecbe-mohou-byt-jeji-nasledky-mirnejsi>
3. [Archive of applications 2022 Military Health Insurance Company ČR 201]. [Internet]. 2022 [cited 2022 Oct 26]. Czech. Available from: <https://www.vozp.cz/archiv-zadosti-2022>
4. [Czech Republic fragment No. f4519046 of Decree No. 39/2012 Coll., on dispensary care – wording from 1 May 2021. In: Laws for people]. [Internet]. 2010-2022 [cited 2022 Oct 26]. Czech. Available from: <https://www.zakonyprolidi.cz/cs/2012-39#f4519046>
5. RES-Q. [Internet]. [cited 2022 Oct 26]. Available from: <https://qualityregistry.eu/the-project/about-uk>
6. World Health Organization (WHO). Indicator Metadata Registry Lis. [Internet]. [cited 2022 Oct 26]. Available from: <https://www.who.int/data/gho/indicator-metadata-registry/imr-details/158>
7. Lindsay MP, Norrving B, Sacco RL, Brainin M, Hacke W, Martins S, et al. World Stroke Organization (WSO): Global Stroke Fact Sheet 2019. *Int J Stroke*. 2019 Oct;14(8):806-17. doi: <https://doi.org/10.1177/1747493019881353>
8. Thrift AG, Howard G, Cadilhac DA, Howard VJ, Rothwell PM, Thayabaranathan T, et al. Global stroke statistics: An update of mortality data from countries using a broad code of "cerebrovascular diseases." *Int J Stroke*. 2017 Oct;12(8):796-801. doi: <https://doi.org/10.1177/1747493017730782>
9. Kim J, Thayabaranathan T, Donnan GA, Howard G, Howard VJ, Rothwell PM, et al. Global Stroke Statistics 2019. *Int J Stroke*. 2020 Oct;15(8):819-38. doi: <https://doi.org/10.1177/1747493020909545>
10. GBD 2016 Stroke Collaborators. Global, regional, and national burden of stroke, 1990-2016: a systematic analysis for the Global Burden of Disease

- Study 2016. *Lancet Neurol.* 2019 May;18(5):439-58. doi: [https://doi.org/10.1016/S1474-4422\(19\)30034-1](https://doi.org/10.1016/S1474-4422(19)30034-1)
11. Dunbar SB, Khavjou OA, Bakas T, Hunt G, Kirch RA, Leib AR, et al. Projected Costs of Informal Caregiving for Cardiovascular Disease: 2015 to 2035: A Policy Statement From the American Heart Association. *Circulation.* 2018 May 8;137(19):e558-77. doi: <https://doi.org/10.1161/CIR.0000000000000570>
  12. Angerova Y, Marsalek P, Chmelova I, Gueye T, Uherek S, Briza J, et al. Cost and cost-effectiveness of early inpatient rehabilitation after stroke varies with initial disability: the Czech Republic perspective. *Int J Rehabil Res.* 2020 Dec;43(4):376-82. doi: <https://doi.org/10.1097/MRR.0000000000000440>
  13. Gimigliano F, Negrini S. The World Health Organization "Rehabilitation 2030: a call for action". *Eur J Phys Rehabil Med.* 2017 Apr;53(2):155-68. doi: <https://doi.org/10.23736/S1973-9087.17.04746-3>
  14. Vackova J. [Social work in the system of coordinated rehabilitation: for clients after acquired brain damage (especially CMP) with special attention to intervention from the point of view of social work, physiotherapy, occupational therapy and other selected professions]. Praha: Grada Publishing; 2020. Czech. doi: [https://doi.org/10.32725/zsf.2020\\_124343](https://doi.org/10.32725/zsf.2020_124343)
  15. Ru X, Dai H, Jiang B, Li N, Zhao X, Hong Z, et al. Community-Based Rehabilitation to Improve Stroke Survivors' Rehabilitation Participation and Functional Recovery. *Am J Phys Med Rehabil.* 2017 Jul;96(7):e123-9. doi: <https://doi.org/10.1097/PHM.0000000000000650>
  16. Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, et al. Guidelines for Adult Stroke Rehabilitation and Recovery: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. *Stroke.* 2016 Jun;47(6):e98-169. Erratum in: *Stroke.* 2017 Feb;48(2):e78. Erratum in: *Stroke.* 2017 Dec;48(12):e369. doi: <https://doi.org/10.1161/STR.0000000000000098>
  17. Minor M, Jaywant A, Togliola J, Campo M, O'Dell MW. Discharge Rehabilitation Measures Predict Activity Limitations in Patients With Stroke 6 Months After Inpatient Rehabilitation. *Am J Phys Med Rehabil.* 2022 Aug 1;101(8):761-7. doi: <https://doi.org/10.1097/PHM.0000000000001908>
  18. Lippert-Gruner M. [Neurorehabilitace]. Praha: Galén; 2005. 350 p. Czech.
  19. Ng YS, Tan KH, Chen C, Senolos GC, Koh GC. How Do Recurrent and First-Ever Strokes Differ in Rehabilitation Outcomes? *Am J Phys Med Rehabil.* 2016 Oct;95(10):709-17. doi: <https://doi.org/10.1097/PHM.0000000000000502>
  20. Valach LK, Selz B. Rehabilitation programs monitored by functional independence measure: an observational study. *Int Phys Med Rehab J.* 2017;2(1):11-6. doi: <https://doi.org/10.15406/ipmrj.2017.02.00039>
  21. Langhammer B, Sunnerhagen KS, Lundgren-Nilsson Å, Sällström S, Becker F, Stanghelle JK. Factors enhancing activities of daily living after stroke in specialized rehabilitation: an observational multicenter study within the Sunnaas International Network. *Eur J Phys Rehabil Med.* 2017 Oct;53(5):725-34. doi: <https://doi.org/10.23736/S1973-9087.17.04489-6>
  22. Li TK, Ng BH, Chan DY, Chung RS, Yu KK. Factors predicting clinically significant functional gain and discharge to home in stroke in-patients after rehabilitation – A retrospective cohort study. *Hong Kong J Occup Ther.* 2020 Dec;33(2):63-72. doi: <https://doi.org/10.1177/1569186120979428>
  23. Boissoneault C, Grimes T, Rose DK, Waters MF, Khanna A, Datta S, et al. Innovative Long-Dose Neurorehabilitation for Balance and Mobility in Chronic Stroke: A Preliminary Case Series. *Brain Sci.* 2020 Aug 14;10(8):555. doi: <https://doi.org/10.3390/brainsci10080555>
  24. Duncan PW, Bushnell CD, Rosamond WD, Jones Berkeley SB, Gesell SB, D'Agostino RB Jr, et al. The Comprehensive Post-Acute Stroke Services (COMPASS) study: design and methods for a cluster-randomized pragmatic trial. *BMC Neurol.* 2017 Jul 17;17(1):133. doi: <https://doi.org/10.1186/s12883-017-0907-1>
  25. Kovarova I, Okaáčova T, Gueye T, Svestkova O. [Stroke: Recommendations for Patients and Their Families]. *Rehabilitation and Physical Medicine.* 2018;3:126-30. Czech. Available from: <https://www.prolekare.cz/casopisy/rehabilitace-fyzikalni-lekarstvi/2018-3-25/cevnni-mozkova-prihoda-soubor-doporuceni-pro-pacienty-a-jejich-rodiny-106639>
  26. Ru X, Dai H, Jiang B, Li N, Zhao X, Hong Z, et al. Community-Based Rehabilitation to Improve Stroke Survivors' Rehabilitation Participation and Functional Recovery. *Am J Phys Med Rehabil.* 2017 Jul;96(7):e123-9. doi: <https://doi.org/10.1097/PHM.0000000000000650>
  27. Saumur TM, Gregor S, Xiong Y, Unger J. Quantifying the amount of physical rehabilitation received by individuals living with neurological conditions in the community: a scoping review. *BMC Health Serv Res.* 2022 Mar 16;22(1):349. doi: <https://doi.org/10.1186/s12913-022-07754-4>
  28. Kaendler S, Ritter M, Sander D, Elstner M, Schwarzbach C, Wagner M, et al. [Position paper on stroke aftercare of the German Stroke Society-Part 1: long-term care after stroke: status quo of the reality and deficits of care in Germany]. *Nervenarzt.* 2022 Apr;93(4):368-76. German. doi: <https://doi.org/10.1007/s00115-021-01231-9>
  29. Bilda K, Stricker S. [Trained stroke helpers: Voluntary care model in outpatient stroke aftercare]. *Z Gerontol Geriatr.* 2021 Feb;54(1):28-36. German. Erratum in: *Z Gerontol Geriatr.* 2021 Jan 4; PMID: 33231762; PMCID: PMC7835164. doi: <https://doi.org/10.1007/s00391-020-01816-0>
  30. Akhtar N, Khan A, Ayyub A. Effect of Delayed Post-Stroke Rehabilitation Program on Patient's Functional Outcome. *Pakistan Armed Forces Medical Journal.* 2018;68(6):1672-6.
  31. Hirota T, Hamada Y, Kaburagi T, Kurihara Y. Estimation of Functional Independence Measure Motor Score Based on a Trunk Control Model. *International Journal of Affective Engineering.* 2022;21(2):101. doi: <https://doi.org/10.5057/ijae.IJAE-D-21-00013>
  32. Tyagi S, Koh GC, Luo N, Tan KB, Hoenig H, Matchar DB, et al. Dyadic approach to supervised community rehabilitation participation in an Asian setting

post-stroke: exploring the role of caregiver and patient characteristics in a prospective cohort study. *BMJ Open*. 2020 Apr 23;10(4):e036631.  
doi: <https://doi.org/10.1136/bmjopen-2019-036631>

33. Norrving B, Barrick J, Davalos A, Dichgans M, Cordonnier C, Guekht A, et al. Action Plan for Stroke in Europe 2018-2030. *Eur Stroke J*. 2018 Dec;3(4):309-36.  
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