01 | 2025 VOLUME 9

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LIFE IN MOTION

Between technology, science & practice

Dear readers,

Few areas of healthcare have seen such remarkable progress over the past twenty years as rehabilitation sciences. We owe this development primarily to new technological possibilities and groundbreaking scientific findings that help us to better understand and apply the effectiveness of our therapeutic interventions. In particular, the growing understanding of neurosciences in terms of how the brain functions and regenerates – for example, after a stroke – enables us today to design rehabilitation in a far more targeted and effective manner.

We are currently in an exciting transitional phase: The focus is moving beyond the basic recognition of rehabilitation's effectiveness towards a more nuanced exploration of how it can be most effectively implemented. In doing so, questions about optimal dose-response relationships and differentiated learning strategies come to the fore. Combination therapies open up new horizons, the effectiveness of which often extends far beyond the sum of the individual parts. This creates a fascinating and sometimes controversial discourse that often questions established concepts – not simply to reject them out of hand but to scrutinise and develop them. This issue of THERAPY provides valuable ideas and food for thought: Results from the PROWALKS study show, for example, how the combination of high-intensity treadmill training and behavioural monitoring can significantly increase step activity in stroke patients. Other articles deepen our understanding of combined approaches, such as integrating device-based balance and treadmill training. New insights into the application of explicit and implicit motor learning strategies further illustrate how complex and promising the path to optimal rehabilitation can be today.

Particularly impressive is a contribution on rehabilitation in Ukraine, which not only tells of solidarity and support, but clearly demonstrates that innovative therapy concepts can emerge and be successfully implemented even under the most difficult conditions.

This issue features an inspiring array of topics that showcase, on multiple levels, the diversity and dynamism of rehabilitation as it continues to evolve – painting a compelling picture on a broader scale.

I wish you a stimulating and engaging read!

Yours,
Jakob Tiebel

Contact the editorial team at: therapy@thera-trainer.com (and tell us what you think!)

12

Standing and
walking combined

62

Use of the bed bike as part of early
mobilisation in the intensive care unit

Intensive robot-assisted
neurological rehabilitation

74

Innovation meets occupational therapy

Cover story

Science

Therapy & practice

Technology & development

Sections

SCIENCE

Differentiated learning strategies in gait rehabilitation

New insights into the influence of explicit and implicit motor learning strategies on the improvement of walking ability in post-stroke patients

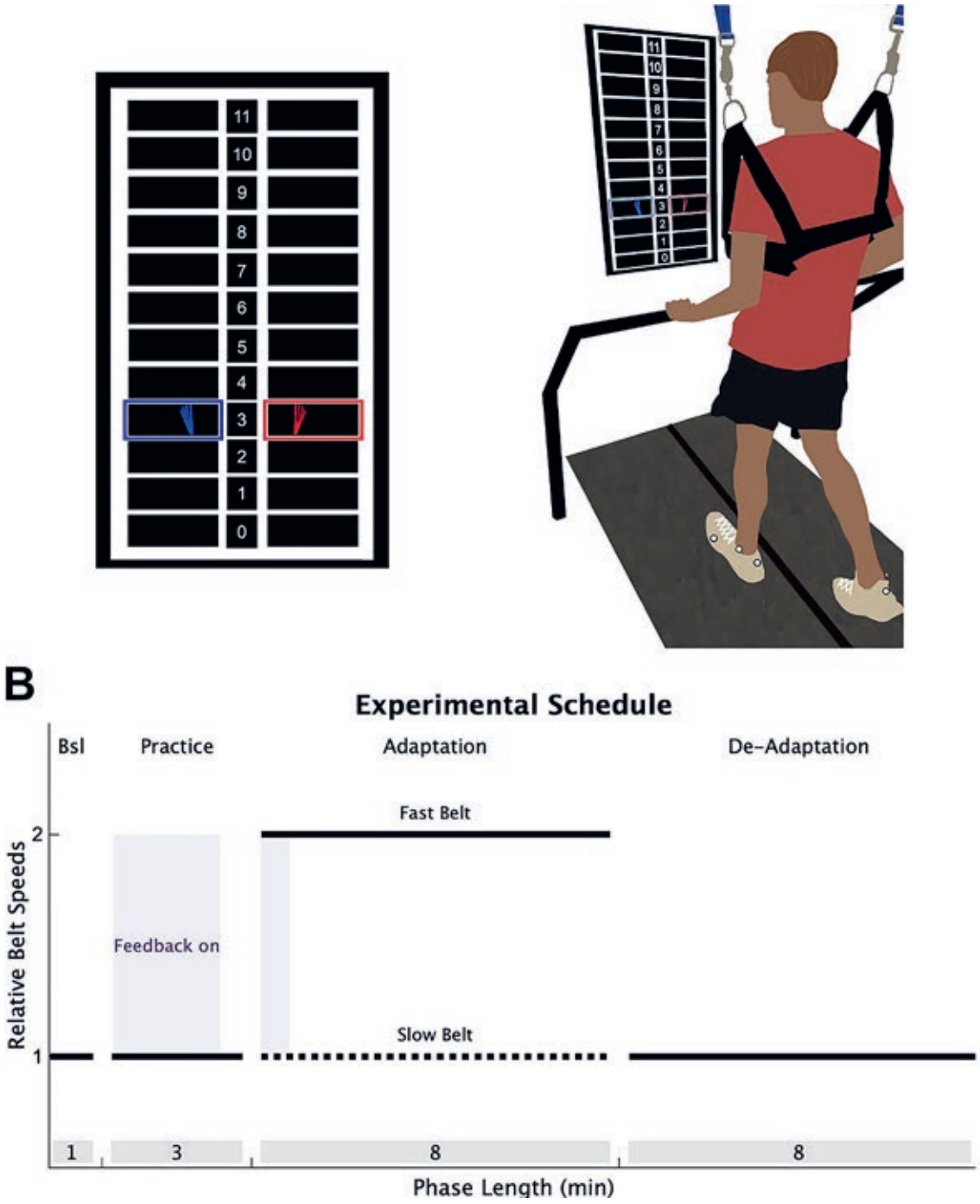
Jakob Tiebel

The study highlights the significance of explicit and implicit motor learning in the rehabilitation of stroke patients. Whereas explicit learning takes place through conscious control and feedback, implicit learning is based on unconscious adaptations to sensory stimuli. Both mechanisms are crucial for the restoration of walking ability, but they are differently impaired after a stroke – with a greater impairment of explicit processes. The results suggest that a combined use of both approaches could optimise rehabilitation. To further improve clinical applicability, however, a deeper investigation of their interactions as well as adaptation to various degrees of impairment is needed.

Background

Stroke is one of the most common causes of permanent disability in adulthood worldwide. Typical consequences include asymmetrical gait patterns, reduced walking speed and an increased risk of falling, which significantly impair the quality of life of those affected. Gait rehabilitation aims to improve these deficits through targeted motor learning strategies. Both explicit (conscious) and implicit (unconscious) learning mechanisms play a key role in this.

Explicit motor learning is consciously controlled through instructions and feedback and requires the active planning and adaptation of move-



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ments, which are primarily processed in the prefrontal cortex. In contrast, implicit learning occurs automatically, with the nervous system detecting and correcting sensory prediction errors. This form of learning, which is controlled by the cerebellum and subcortical structures, enables intuitive adaptation to sensory stimuli without conscious control by the patient.

Implicit learning in particular makes a crucial contribution to the sustainable integration of movement patterns, as it requires fewer cognitive resources and supports everyday movements. In contrast, explicit learning enables precise corrections, particularly in the early rehabilitation phase.

Through targeted manipulation of asymmetric gait patterns, it was possible to differentiate and analyse motor learning.

Stroke patients exhibit deficits in both conscious learning and automatic adaptation.

The study by Wood and colleagues at the US Department of Physical Therapy at the University of Delaware examines the impairments of explicit and implicit learning processes in individuals with chronic stroke and highlights their relevance for clinical practice under practical laboratory conditions.

Methodology

In the study, the researchers used an experimental paradigm to investigate explicit and implicit motor learning in individuals with chronic stroke and a control group of healthy participants. The sample included individuals with chronic stroke and an age- and gender-matched control group to make differences in motor learning comparable between the groups.

The experiments were carried out on what is known as a split-belt treadmill. This treadmill has two independently movable belts that can run at different speeds under each foot. This arrangement generates asymmetrical gait patterns, which are specifically used to analyse motor adaptation processes. The split-belt treadmill provides a controlled environment in which motor learning can be provoked and measured through manipulation of walking conditions.

After an initial baseline phase, in which both treadmills ran at the same speed and no visual feedback was given, the subjects completed a 3-minute practice phase. This phase served to familiarise the participants with the visual feedback and to ensure that they were able to consciously respond to the feedback by specifically adapting their step lengths. The step length targets were initially set to the individual baseline step lengths of the participants, before being shifted in the short term by ±10 cm to promote conscious control and strategic adaptation of movement.

This was followed by an 8-minute adaptation phase, in which the treadmills ran at different speeds. The faster treadmill moved at the maximum walking speed of the participants, while the slower treadmill was operated at half speed. This difference in speed produced asymmetrical step lengths, which the participants were expected to strategically correct by consciously using the visual feedback. The first 40 steps of this phase were focused on explicit learning, as the participants were instructed to actively correct step errors using the visual information.

After these 40 steps, the visual feedback was removed, and the participants were instructed to continue walking in a gait pattern that was comfortable for them. This change deliberately eliminated controlled adaptations and focused instead on implicit learning. During this phase, adaptations occurred unconsciously through sensory prediction errors, with the nervous system automatically responding to the asymmetric load, to restore a symmetrical gait pattern.

To evaluate the learning mechanisms, a novel adaptation index was developed based on a voluntary correction model approach. This index enabled a precise separation of the contributions of explicit and implicit learning processes:

Explicit learning was quantified by the conscious adaptations of step length during the phase with visual feedback.

Implicit learning was measured based on the after-effects, i.e. the automatic adaptations in step length following the removal of feedback and the return to baseline.

Individually tailored learning strategies are the key to effective recovery of motor skills after a stroke.

This methodology allowed a detailed differentiation of the two learning mechanisms and their effectiveness in the participants, providing new insights into the motor adaptation processes following a stroke.

Following completion of the adaptation phase, there was an 8-minute de-adaptation phase, in which both treadmills were operated at the same speed as in the baseline phase. In this phase, the participants were instructed to "walk comfortably". The focus here was on measuring the after-effects of the asymmetrical load that was generated during the adaptation phase.

Combined approaches that specifically address cognitive and motor deficits could significantly improve rehabilitation outcomes in the future.

The de-adaptation phase allowed for a more precise evaluation of implicit adaptation by observing how the nervous system responded to the changed treadmill conditions. The extent to which subjects maintained asymmetric stepping patterns, despite the external asymmetry being removed, was used as a measure of the strength of the implicit after-effect. This reflects the total magnitude of implicit adaptation that had taken place during the adaptation phase.

The data from the de-adaptation phase were also integrated into the adaptation index to obtain a complete picture of the implicit learning processes. The phase thus served as a crucial component for the separation and quantification of the automatic adaptation mechanisms that operate independently of conscious control processes.

Results

The results show that individuals with stroke exhibited a limited capacity for explicit learning compared to the control group. This impairment was evident in the smaller difference in the adaptation index between phases with and without visual feedback during the adaptation phase (mean [95% HDI]: 0.09 [-0.05 0.25], probability of a difference = 88.2%). In addition, the adaptation index during the feedback phase was significantly lower for the stroke group than for the control group (mean difference = 0.23 [0.11 0.34], probability of a difference = 100.0%). These results demonstrate that individuals with stroke use visual feedback less effectively and have a reduced ability for conscious adaptation to errors.

Implicit adaptation was also impaired in the stroke group. This was measured by smaller implicit after-effects, which indicate lower adaptations by the nervous system (group difference = 0.10 [–0.02 0.21], probability of a difference = 94.3%). At the end of the adaptation phase, the stroke group also showed significantly lower values than the control group (group difference = 0.17 [0.07 0.28], probability of a difference = 99.9%). These results suggest that both explicit learning and implicit adaptation are impaired following a stroke.

For a more detailed examination of learning processes, a model was used that separately analysed conscious (explicit) and unconscious (implicit) learning. The results showed that adaptability was overall lower in the stroke group compared to the control group, indicating greater differences and variabilities within the stroke group.

Conscious learning was measured through the adaptation index, which quantified how quickly and effectively participants could respond to visual feedback. Here the stroke group performed significantly worse than the control group. This confirms that conscious learning is limited in post-stroke individuals.

The analysis of the unconscious adaptations, in contrast, showed only small differences between the two groups in most of the areas

investigated. However, a clear difference was noted in the ability to retain previously learned information over the long term. This ability was noticeably less pronounced in the stroke group, which offers a possible explanation for the overall slower automatic adaptation processes following a stroke.

Discussion

The results show that individuals with stroke have difficulties using conscious learning effectively. This manifested itself in fewer behavioural changes after the visual feedback was removed and in slower adaptation processes, which were confirmed by model analyses. These differences are not solely attributable to motor limitations but indicate specific difficulties in conscious error correction.

Unconscious adaptability was also impaired in participants with stroke. Their adaptation of movements was slower and less complete compared to the control group with healthy subjects. The model analyses suggest that these delays might be attributable to a limited capacity for long-term storage of new movement patterns. This could be explained by damage in the brain regions responsible for movement and learning.

The results illustrate that both conscious and unconscious learning processes require different approaches in rehabilitation. Conscious learning could be promoted through clear instructions and targeted feedback, while unconscious adaptations should be supported through repeated practice and long-term stabilisation.

Conclusion

Researchers are coming to the realisation that people after a stroke show limitations in various types of motor learning, which cannot be attributed solely to motor deficits. These findings are important in order to better adapt rehabilitation programmes to the specific needs of those affected in the future and thus promote the restoration of motor skills through the selection of suitable learning strategies. Future research must now examine how training methods can be structured to specifically strengthen conscious and unconscious learning and secure long-term progress.

Implications for practice

The results show that rehabilitation after a stroke should target both conscious learning processes (through clear instructions and specific feedback) as well as unconscious adaptation mechanisms (through repetition-based exercises and sensory challenges). Combined approaches that promote both mechanisms simultaneously or sequentially could shape the restoration of motor skills more effectively. Individually tailored training programmes that take into account the specific deficits of each patient offer the potential to optimise rehabilitation outcomes and ensure long-term improvement of everyday competencies. For this purpose, it is important, within the scope of motor therapies, not only to consider the motor deficits, but also to critically reflect on the cognitive resources when selecting suitable learning strategies.

l.ead.me/therapy-25-01-06

Specific limitations in conscious error correction and the storage of new movement patterns require targeted rehabilitation strategies.

Comments

This is a theoretically sound yet highly practical study whose insight goes beyond the mere fact that stroke patients learn more slowly – something that experienced practitioners know from experience. The new core finding lies in the differentiated analysis of the specific mechanisms underlying the learning difficulties of stroke patients, and the identification of targeted approaches to address these effectively.

What are the most important findings?
Explicit learning is impaired independently of motor limitations. The study shows that deficits in conscious learning (explicit learning) are not solely conditioned by motor impairments. Even patients with better motor control struggled to consciously correct errors and effectively utilise visual feedback. This suggests that cognitive processes such as working memory or the processing of feedback play a key role.

Slower adaptation through specific impairment of implicit learning processes. The study also shows that not all unconscious (implicit) adjustment is impaired, but specifically the ability to quickly react to errors and store them. This was demonstrated for the first time in a differentiated manner through the modelling of the adaptive learning process in a locomotion task.

Explicit learning does not inhibit implicit adaptation: Another interesting result is that conscious learning (explicit feedback) does not impair unconscious adaptation. This is important as it is often assumed that these two processes could compete with each other. The results show that both processes can run independently of each other, which means that rehabilitation programmes can certainly combine these approaches without risking a deterioration in outcome.

New methodological approaches to the separation of learning processes: The study is the first to analyse both explicit and implicit learning in a locomotion task in stroke patients using a combination of behavioural tests and computer-assisted modelling. The voluntary correction model used offers a new tool for the future to precisely quantify and differentiate learning processes.

Why are these findings important?
The results emphasise the importance of giving greater consideration to cognitive processes such as feedback processing and memory performance in motor rehabilitation. In the context of motor therapy, attention is usually only given to motor functions.

The study goes beyond the general understanding that stroke patients learn more slowly, and provides new mechanistic explanations that have previously received little attention in rehabilitation. The modelling of learning provides an important basis for the future in order to develop more effective personalised training methods.

Sources
Wood JM, Thompson E, Wright H, Festa L, Morton SM, Reisman DS, Kim HE. Explicit and implicit locomotor learning in individuals with chronic hemiparetic stroke. J Neurophysiol. 2024 Oct 1;132(4):1172-1182. doi: 10.1152/jn.00156.2024. Epub 2024 Sep 4. PMID: 39230337; PMCID: PMC11495209.

SCIENCE

Standing and walking combined

The influence of robot-assisted gait training on balance and fear of falling in stroke patients

Jakob Tiebel

The combination of standing and gait trainers offers stroke patients a varied training regime with multiple stimuli.

Combined therapeutic approaches that incorporate device-based balance and treadmill training open up new perspectives in stroke rehabilitation. The combination of standing and walking offers patients multiple sensory and motor stimuli, which encourage neuroplastic processes and accelerate functional progress. At the same time, modern therapy equipment allows for precise measurements and individual adjustments, enabling long-term improvements in mobility and quality of life.

A study published in the American Journal of Physical Medicine & Rehabilitation by Gunduz and colleagues from Istanbul examined the effectiveness of a combined training approach that combines robot-assisted gait training with balance training compared to balance training alone in stroke patients.

The intervention extended over a period of five weeks, during which 42 patients were divided into two groups. The intervention group underwent combined training, consisting of balance exercises and robot-assisted gait training, while the control group received conventional balance training only. The study objective was to evaluate improvements in balance, fear of falling, as well as the function of the lower extremities.

Balance was analysed with an app that recorded standing and sitting times as well as directional sways (anterior, medial, lateral) during walking. In addition, the Berg Balance Scale, the Timed Up and Go Test, the International Fall Efficacy Scale and the Fugl Meyer Assessment Test were used for the clinical evaluation of the primary and secondary endpoints.

The results of the study show that the group with combined training achieved significant progress in directional sways, standing and sitting times, balance, as well as fear of falling. The group with balance training alone also recorded improvements, particularly in relation to mobility and function of the extremities. In direct comparison, combined training proved superior in terms of standing and sitting times, while traditional balance training achieved better results in limb function.

The study suggests that an integrative approach, combining robot-assisted gait training with balance training, is particularly effective for improving balance and reducing fear of falling. The results highlight the usefulness of such an approach in subacute and chronic stroke rehabilitation, as it meaningfully extends the advantages of the individual methods.

l.ead.me/therapy-25-01-12

Comments

The results of the study illustrate the potential of combined approaches in stroke rehabilitation, particularly through the connection between robot-assisted gait training and balance training. This approach demonstrates an effective way to specifically address particular motor deficits, while simultaneously improving balance and fear of falling. The intervention offers a useful addition to existing rehabilitation concepts by integrating static and dynamic training stimuli.

A key benefit of combined training is the possibility of promoting different motor skills simultaneously. Balance training supports postural control and stability, while robot-assisted gait training addresses mobility and implicit motor learning through repetitive movement patterns. This combination creates different sensory and motor stimuli that support the neuroplastic adaptation of the central nervous system, thus enabling functional restoration at multiple levels.

The integration of equipment such as standing and walking trainers into defined therapy pathways creates a combined training approach.

Sources

The Effects of Robot-Assisted Gait Training on Balance and Fear of Falling in Patients with Stroke: A Randomized Controlled Clinical Trial. Am J Phys Med Rehabil. 2024 Dec 3. doi: 10.1097/PHM.0000000000002674. Epub ahead of print. PMID: 39642346.

The standardised procedures and precise control through robot-assisted technologies are an additional benefit of the intervention. They enable a differentiated adjustment of training intensity to the individual needs of patients and, through integrated measurement systems, provide a reliable basis for progress documentation and adaptation of therapy. This structure can be particularly advantageous in the sub-acute and chronic phases of rehabilitation in order to address patients' deficits in a targeted and efficient manner.

In summary, the study provides evidence-based indications of the effectiveness of a combined training approach and its contribution to improving balance and reducing fear of falling in stroke patients. The results underline the value of a structured integration of modern technologies into rehabilitation practice.

New dimension of gait therapy

Opening of the Gait Continuum with THERA-Trainer training equipment at the Passauer Wolf Reha-Zentrum in Bad Griesbach

Leoni Schulz

The opening of the innovative Gait Continuum was celebrated on 9 October 2024 at Passauer Wolf Reha-Zentrum in Bad Griesbach. Among the many guests were Jürgen Fundke, First Mayor of Bad Griesbach, as well as Dieter Weinzierl, Rehabilitation Centre Director. After the welcome by Dr Oliver Meier, Medical Director and Chief Physician of Neurology and Geriatrics, visitors were able to experience the state-of-the-art gait therapy equipment in action and meet the therapy team.

At the heart of the new therapy room is the end-effector gait trainer THERA-Trainer lyra

At the heart of the new therapy room is the end-effector gait trainer THERA-Trainer lyra, which sets new standards in gait rehabilitation with its advanced robot-assisted technology. With the aim of sustainably improving the mobility and quality of life of patients, the Gait Continuum offers a variety of state-of-the-art equipment that is individually tailored to patient needs.

"The Gait Continuum is a great asset to our therapeutic work. The close integration of people and technology opens up completely new perspectives for gait therapy. Robot-assisted therapy equipment improves patient mobility and performance in a targeted way and can be individually adapted to patient needs," says Barbara Göttert, Head of Therapy at Passauer Wolf.

The THERA-Trainer lyra is particularly impressive with its ability to simulate natural gait movements, thereby stimulating patients' muscle memory. Adjustable weight relief means that even immobile patients can train up to 100 steps per minute – an intensity that would be barely achievable without technological support.

Highest level of efficiency and tailored rehabilitation

Another highlight of modern rehabilitation technology at Passauer Wolf Reha-Zentrum is the interactive training equipment THERA-Trainer senso. This equipment combines cognitive and motor exercises, which not only enhances physical performance but also promotes mental capacity and significantly reduces the risk of falls. Mayor Fundke, who tested the equipment himself at the opening ceremony, congratulated the team at Passauer Wolf, which is known for its expertise in this field and "puts Bad Griesbach firmly on the map".

"The Gait Continuum is a great asset for our therapy work"

Another highlight of modern rehabilitation technology at Passauer Wolf Reha-Zentrum is the interactive training equipment THERA-Trainer senso.

The future of rehabilitation: people and technology in harmony

In his speech, Dr Oliver Meier emphasised the importance of technical innovations for modern rehabilitation medicine. "Technological innovations are an essential part of modern rehabilitation medicine. Our patients benefit from this valuable combination of advanced technology and human expertise – this enables visible progress and supports them on their journey back to a self-determined life."

The close partnership with THERA-Trainer underlines the commitment of Passauer Wolf to make rehabilitation processes more efficient and sustainable through the use of advanced technologies such as the THERA-

Trainer lyra and senso. Regional broadcaster Niederbayern TV was also at the opening ceremony of the Gait Continuum and their report is available online in German under the title *Innovatives Therapieangebot: Eröffnung des »Gangkontinuums« im Passauer Wolf Reha-Zentrum* (Innovative therapy offering: Opening of the Gait Continuum at Passauer Wolf Reha-Zentrum).

Watch the video:
l.ead.me/therapy-25-01-16_01

With the use of cutting-edge THERA-Trainer therapy equipment, Passauer Wolf is once again setting new standards in gait therapy and demonstrating that people and technology can together unlock a new dimension of rehabilitation.

Leoni Schulz has been supporting the editorial team of THERAPY magazine since mid-2024. In addition to her responsibilities for layout and typesetting, she also works as an editor. She writes her own contributions and articles for the editorial. Thanks to her many years of experience in rehabilitation and medical technology, she brings cross-industry knowledge and valuable insights to her articles.

l.ead.me/therapy-25-01-16_02

SCIENCE

The PROWALKS protocol

PROWALKS: Protocol for promoting recovery optimization of walking activity in stroke – development of clinical profiles and targeted interventions to optimise daily walking in stroke patients.

Jakob Tiebel

The PROWALKS study provides significant insights for optimising rehabilitation in stroke patients. By combining high-intensity treadmill training and step-activity behavioural intervention, the daily step count was significantly increased. Using modern statistical models, the researchers identified three clinical patient groups with specific characteristics and responses to the interventions. The results underline the necessity to develop personalised rehabilitation programmes that effectively promote both walking capacity and daily activity. A crucial step towards patient-centred and sustainably effective stroke rehabilitation.

Background

People with chronic stroke reach an average of only 4,000 steps per day and rarely meet the recommended guidelines for physical activity (Moore et al. 2010). This low level of activity increases the risk of recurrent strokes and more severe disabilities. Studies show that step-activity behavioural interventions combined with high-intensity treadmill training can significantly increase daily step count (Bravata et al. 2007). The PROWALKS study investigated these approaches with the aim of optimising walking activity through personalised rehabilitation measures.

Step-activity behavioural intervention proved to be particularly effective in increasing the daily step count.

The combination of intensive physical training and behavioural therapeutic approaches is no longer an option – it is a necessity.

Info: The PROWALKS study

What is the PROWALKS study?

The Promoting Recovery Optimization of Walking Activity in Stroke (PROWALKS) study is a multicentre, randomised, controlled clinical trial investigating how different rehabilitation approaches can improve daily step activity in people with chronic stroke.

Study objectives:

- Increase in daily step activity.
- Comparison of the efficacy of three intervention approaches:
  a) **High-intensity treadmill training (FAST)**: Improvement of walking capacity.
  b) **Step-activity behavioural intervention (SAM)**: Motivation and monitoring to increase activity.
  c) **Combination of FAST and SAM (FAST+SAM)**: Integration of both approaches.

Who conducted the study?

The study was conducted by an interdisciplinary team of experts in rehabilitation medicine, neurology and behavioural research. It was carried out at four university and clinical laboratories in the USA.

Study population:

- 250 participants with chronic stroke (at least 6 months after the event).
- Requirements Walking speed of 0.3–1.0 m/s, fewer than 8,000 steps per day and the ability to walk independently.

Duration and methodology:

- Intervention period: 12 weeks with two to three sessions per week.
- Main objective: Increase in average daily step count as measured by validated fitness trackers.

Scientific significance:

The PROWALKS study is one of the first investigations to systematically research personalised rehabilitation approaches for increasing daily physical activity.

Results of the first evaluation (2018):

The first analysis focused on comparing the effectiveness of the three interventions regarding the increase in step activity (steps per day) in people with chronic stroke. The most important results were:

- **SAM (step-activity behavioural intervention)**: Participants significantly increased their step count by an average of **1,542 steps per day**.
- **FAST+SAM (combined intervention)**: This group also showed a significant improvement with **1,307 additional steps per day**.
- **FAST (intensive treadmill training)**: The sole increase in capacity did not lead to any significant change with only **406 additional steps per day** (p=0.09).

The results showed that only participants who received a behavioural intervention with targeted coaching and progress monitoring (SAM or FAST+SAM) were able to significantly increase their physical activity in daily life. High-intensity treadmill training (FAST) was insufficient for daily activity.

Current results (second analysis):

The current analysis is the second evaluation of the PROWALKS data. It focuses on how specific clinical profiles (e.g. walking capacity, balance, cognition, socioeconomic conditions) relate to the effectiveness of the interventions. This provides important insights in terms of tailoring rehabilitation programmes to individual patient needs in the future (see current article).

Identification of clinical profiles

A secondary analysis of the PROWALKS study was published at the end of 2024 and provides new insights into the personalisation of rehabilitation measures to improve walking ability in the daily lives of chronic stroke patients. The analyses were conducted by a multidisciplinary team of researchers and clinicians, including experts in neurology, physiotherapy and statistics. A consortium of the University of Delaware in the USA led the work.

The researchers specifically investigated, using the available datasets, how stroke patients with different clinical profiles respond to measures aimed at improving walking capacity and daily performance. Eight clinical variables were considered, including walking capacity, balance, cognitive abilities and socioeconomic conditions.

The participants had non-cerebellar strokes that had occurred at least 6 months before patient enrolment in the study. They were between 21 and 85 years old, had walking speeds of 0.3–1.0 m/s and took fewer than 8,000 steps per day.

Using **latent variable mixture models (LVMMs)**, a statistical technique for identifying hidden subgroups in heterogeneous datasets, homogeneous patient groups ("classes") were identified. LVMMs enable the discovery of patterns in data that would not be visible using conventional statistical analysis methods. LVMMs used the relationship between observable variables (e.g. walking capacity) and underlying latent variables (e.g. cognitive abilities and socioeconomic conditions) to form hidden groups with similar characteristics.

The LVMM produced three clearly defined patient groups with specific baseline characteristics and different responses to the interventions.

Although pure treadmill training (FAST) improves walking capacity, it rarely leads to a significant increase in daily activity.

Class 1: Lowest walking capacity, lowest balance self-efficacy, weakest cognition and highest area deprivation.

Class 2: Moderate walking capacity, moderate cognition and balance, as well as moderate socioeconomic conditions.

Class 3: Highest walking capacity, highest balance self-efficacy, strong cognitive performance and lowest area deprivation.

The three intervention approaches of the PROWALKS study

In the PROWALKS study, three different intervention approaches were investigated to promote walking activity in stroke patients and increase their daily step counts.

1. High-intensity treadmill training (FAST)

High-intensity, or fast, treadmill training (FAST) focuses on improving walking speed and cardiorespiratory fitness. It included:

High intensity: The participants trained on a treadmill at a speed close to their maximum walking speed.

Progressive load: The training intensity was gradually increased to maximise walking capacity.

Objective: The objective was to increase walking speed and endurance in order to improve mobility and efficiency when walking in daily life.

2. Step-activity behavioural intervention (SAM)

The aim of step activity monitoring (SAM) was to motivate participants to increase their daily step count. The approaches include:

Behaviour-based objective: Participants set step goals based on their current walking activity.

Feedback and self-monitoring: Using pedometers or activity trackers, participants received feedback on their daily activity.

Motivation strategies: Coaching and support promoted patient involvement and help to achieve their goals.

3. Combined intervention (FAST+SAM)

The combined intervention (FAST+SAM) combined the benefits of high-intensity treadmill walking and step activity monitoring. This approach offered:

Physical training: Treadmill walking (FAST) was used to improve physical walking capacity.

Motivational support: The behavioural component (SAM) encouraged participants to apply the skills acquired in training to their daily lives.

Synergy effects: The combination aimed to improve walking ability, endurance and daily activity simultaneously.

Results of the interventions in detail

The efficacy of the three tested intervention approaches varied significantly between the identified classes of stroke patients. The results show that each class responded specifically to different approaches, which underscores the importance of individualised rehabilitation.

Class 1: Patients with the lowest walking capacity and high support needs

This group comprised patients with the lowest walking capacity, lowest balance self-efficacy, and severely impaired cognition. In addition, they were more severely affected by socioeconomic disadvantage than other classes.

SAM (step-activity behavioural intervention): Participants in this group recorded the best results with an average increase of **1,624 additional steps per day**. Simple monitoring and motivation to increase step count appears to be particularly effective for this group, as it directly addresses daily activity.

FAST+SAM (combined intervention): The combination of treadmill training and behavioural monitoring also led to a substantial improvement with **1,150 additional steps per day**. This approach is particularly effective as it promotes both walking ability and activity.

FAST (high-intensity treadmill training): This intervention focused purely on walking ability and was at least helpful for this group with a slight increase of **314 steps per day**. These results illustrate that these patients have little motivation to increase their activity through treadmill training alone.

Recommendation: SAM or FAST+SAM are the most effective approaches for patients in class 1. While SAM achieves the greatest increase in step activity, FAST+SAM also improves walking ability, making it a valuable option for long-term progress.

Class 2: Patients with moderate walking ability and moderate support needs

This group was characterised by a medium walking capacity, average cognition and balance, as well as moderate socioeconomic conditions.

SAM (step-activity behavioural intervention): The participants in this group achieved the greatest progress with SAM, with an increase in daily step count of **2,002 steps per day**. These impressive results underscore that

a focused behavioural intervention is sufficient to motivate this group and significantly increase their activity.

FAST+SAM (combined intervention): Although FAST+SAM also achieved positive results, the increase with **867 additional steps per day** was significantly less than with SAM alone. The combined intervention could be less effective for this group, as it does not provide significant added value beyond SAM.

FAST (high-intensity treadmill training): In this group, FAST even led to a decrease in step activity by an average of **219 steps per day**. This shows that high-intensity treadmill training without behavioural support is not only ineffective but may also have demotivating effects.

Recommendation: A purely behavioural intervention (SAM) is the best option for class 2. It promotes daily activity most effectively and is particularly motivating for this group.

Class 3: Patients with the best walking ability and lower support needs

Patients in class 3 had the highest walking capacity, highest balance self-efficacy and strongest cognitive performance. The socioeconomic conditions of this group were also generally more favourable.

FAST+SAM (combined intervention): This group benefited the most from the combined intervention with an increase in daily step count of 1,532 steps per day. The combination of treadmill training and activity monitoring is particularly effective for these patients, as it addresses both the physical and motivational component.

SAM (step-activity behavioural intervention): SAM also led to an increase in the number of steps, however, the increase was significantly lower with 661 additional steps per day compared to FAST+SAM. For this group, a purely behavioural intervention is not sufficient to exploit the full potential.

FAST (high-intensity treadmill training): FAST alone led to a moderate increase of 390 steps per day. Although the intervention in this group was not completely ineffective, it is clearly inferior to the combined intervention.

Recommendation: The FAST+SAM combination is the most effective method for class 3. This intervention optimally addresses the needs of this group by developing existing walking ability while significantly increasing daily activity.

The results highlight the necessity of a targeted selection of rehabilitation measures based on individual patient characteristics. The effectiveness of the interventions varied partly between the classes with the importance of step-activity behavioural intervention becoming apparent across classes in increasing motivation and readiness for behavioural change.

Importance of personalised rehabilitation

The PROWALKS study provides valuable insights for optimising rehabilitation after a stroke. The use of clinical profiles to individualise interventions has the potential to sustainably reduce low physical activity and its negative consequences in people with chronic stroke.

Patients with different clinical profiles respond differently to rehabilitation approaches

Comment: The next paradigm shift in gait rehabilitation is due

The results of the PROWALKS study provide clear evidence that stroke rehabilitation is still far from achieving its full potential. As already discussed in the review article Walk the Talk: Current Evidence for Walking Recovery After Stroke (https://doi.org/10.1161/STROKEAHA.122.03895), a purely training-based approach to improving walking capacity is insufficient to enhance daily performance and quality of life for patients on a long-term basis.

The PROWALKS study impressively demonstrates that improvements in walking capacity, for example through high-intensity treadmill training, do not necessarily lead to increased activity in daily life. This shows that it is not enough to merely make patients physically fitter. Without a targeted behavioural and psychological intervention aimed at promoting the motivation and ability to integrate into daily life, the performance, i.e. the actual application of the skills acquired in training, falls short of expectations.

For the sake of clarity, it should be noted that this is by no means intended to bring into question a highly repetitive exercise approach, which has been proven effective and is supported by the best evidence in neurological rehabilitation for the restoration and improvement of walking ability. Quite the opposite. Current research in this field even suggests that we may still be approaching training control and progression with insufficient intensity and progression. It remains undisputed that intensive, repetition-based training continues to form the foundation of gait rehabilitation.

However, doing one thing must not mean neglecting the other. The challenge lies in combining intensive training with effective approaches to promote the transfer to daily life. After all, we cannot avoid the critical point of transferring training progress into the patients' everyday reality.

The new results reveal a critical need for action: rehabilitation programmes must be thoroughly reconsidered and restructured. The combination of intensive physical training and behavioural therapeutic approaches is no longer an option – it is a necessity. Only through this integration can the discrepancy between capacity and performance be overcome. It is time to address the transfer of training progress into the lived experience of patients in a systematic and evidence-based way.

Future rehabilitation must therefore be more strongly oriented towards the participation level, where daily activities and quality of life are front and centre. The challenge is not only to develop new intervention methods, but also to fundamentally change the paradigm of rehabilitation, moving away from a purely capacity-oriented approach towards a holistic, patient-centred perspective. Only in this way can we ensure that the progress made does not fizzle out in everyday clinical practice, but actually brings about sustainable change in the lives of those affected.

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THERA-Trainer customer feedback analysis

A Systematic Analysis of Customer Feedback on THERA-Trainer Rehabilitation Devices: Insights into User Satisfaction and Product Performance.

Jakob Tiebel

This systematic analysis of customer feedback highlights the widespread satisfaction with THERA-Trainer rehabilitation devices among patients and healthcare professionals. The findings emphasize the devices' versatility, user-friendliness, and significant therapeutic impact across diverse settings, including acute care, rehabilitation facilities, and home environments. With 84% of feedback reflecting positive sentiment, THERA-Trainer is recognized as a trusted leader in improving mobility and recovery outcomes. These insights provide a strong foundation for future innovation and continuous improvement in rehabilitation technology.

Background

For over three decades, THERA-Trainer has been recognized as a leader in rehabilitation technology, renowned for its innovative solutions in neurological and geriatric care. Guided by its mission – embodied in the slogan "for a life in motion"– the company offers a comprehensive portfolio of advanced devices and software designed to meet a wide range of rehabilitation needs. From motor-assisted cycling trainers to electromechanical gait

THERA-Trainer devices seamlessly integrate into diverse rehabilitation settings, delivering personalized care and earning a remarkable 84% positive user sentiment.

devices and dynamic standing aids, THERA-Trainer provides state-of-the-art equipment that fosters recovery, strengthens mobility, and supports lasting improvements. The integration of advanced software further enhances these solutions, delivering customized therapy programs with real-time biofeedback, and an engaging, user-focused experience.

THERA-Trainer devices are employed globally across a wide array of rehabilitation settings, including acute and intensive care units, inpatient rehabilitation facilities, outpatient therapy clinics, long-term care centers, and home environments. Despite the company's significant international presence and the wealth of user feedback accumulated over the years, a comprehensive analysis of these insights had not been undertaken—until now. This review aimed to systematically collect, structure, and examine customer feedback, offering a detailed understanding of the experiences and perceptions that guide ongoing innovation and improvements in rehabilitation technology.

Methodology

The project adopted a explorative systematic methodology to collect and analyze customer feedback on THERA-Trainer products. By drawing on a wide array of data sources, organizing the information methodically, and applying qualitative and quantitative analysis techniques, the approach provided a well-rounded and in-depth understanding of user experiences and perceptions.

Data Collection

To gather customer feedback comprehensively, the search extended across both internal and external sources:

External Sources: Publicly available information from online platforms, social media channels, industry publications, journals, and corporate reports contributed to the dataset. Video content, such as user statements shared on YouTube and Vimeo, was also reviewed for relevant insights.

Internal Sources: THERA-Trainer's quality management systems served as a secondary source, providing regularly documented customer reports and user feedback. Additionally, internal company reports containing user insights were included in the analysis.

The data collection process employed an exhaustive search strategy with no temporal restrictions, ensuring the capture of all accessible feedback, regardless of when it was published. This approach allowed for a comprehensive and diverse dataset that reflects both historical and recent customer experiences.

Data Structuring

The gathered customer feedback was systematically arranged within a relational database structure, enabling organized and efficient data management. Key metadata were recorded for each feedback entry, including:

1. **Source and Origin**: Each feedback entry was categorized based on its original source or platform, such as social media channels, industry publications, corporate reports, or internal quality management systems. In addition, the feedback was assigned to one of two primary user groups:

   Patients and Relatives: Feedback from individual end-users and their families, often reflecting personal experiences, emotional milestones, and the perceived impact of the products on their daily lives.

   Healthcare Professionals: Feedback from physical therapists, occupational therapists, medical directors, and other clinical staff, typically emphasizing technical performance, clinical outcomes, and professional observations.

2. **Relevant Product Group:** Classification into one of the primary categories – Cycling, Standing & Balancing, Gait, and Software.

3. **Context of Use:** The environment or setting (area of application) in which the feedback was relevant, such as Acute Care, Inpatient Rehabilitation, Outpatient Rehabilitation, Long-Term Care, or Home Training.

This structured approach ensured that all feedback could be easily retrieved, analyzed, and compared across different product categories and usage scenarios.

Data Analysis

The categorized customer feedback entries served as the foundation for detailed group and subgroup analyses, providing a structured approach to uncovering distribution patterns and weighting factors. By grouping statements according to product categories and application contexts, the analysis was able to identify trends, highlight differences in user priorities, and track variations in customer sentiment across distinct scenarios.

For example, the grouping of feedback into product categories – such as Cycling, Standing & Balancing, Gait, and Software – allowed for comparative evaluations, revealing which products were most frequently discussed and the contexts in which they were considered most effective. Application context categories (e.g., Acute Care, Home Training) further enabled targeted assessments of how products performed in various clinical and personal settings. Cluster analysis leveraged these groupings to pinpoint distinct opinion segments, helping to identify key user priorities, such as a preference for technical precision or a focus on patient-centered outcomes.

Overall, the predefined categories and the segmentation of data by user group and usage context provided a clear framework for exploring the distribution and relative importance of different perspectives. This structured approach made it possible to visualize feedback trends, assess sentiment balance, and derive more meaningful conclusions about customer needs and product impact.

The feedback analysis involved assigning sentiment scores ranging from neutral to positive. Neutral feedback provided objective descriptions of product use, while positive feedback reflected satisfaction or endorsement. To quantify overall sentiment, entries were grouped into three categories: *Promoters* (positive sentiment with clear satisfaction and endorsement), *Passives* (neutral sentiment offering factual observations), and *Detractors* (negative sentiment showing dissatisfaction or criticism). Using these classifications, a Net Promoter Score (NPS) was calculated by subtracting the percentage of Detractors from the percentage of Promoters.

To achieve all these results, the analysis relied on a range of computational tools. Python and R libraries supported text mining and natural language processing, while advanced artificial intelligence techniques – such as training a Large Language Model (LLM) on a subset of the data – enabled more sophisticated pattern recognition and thematic exploration.

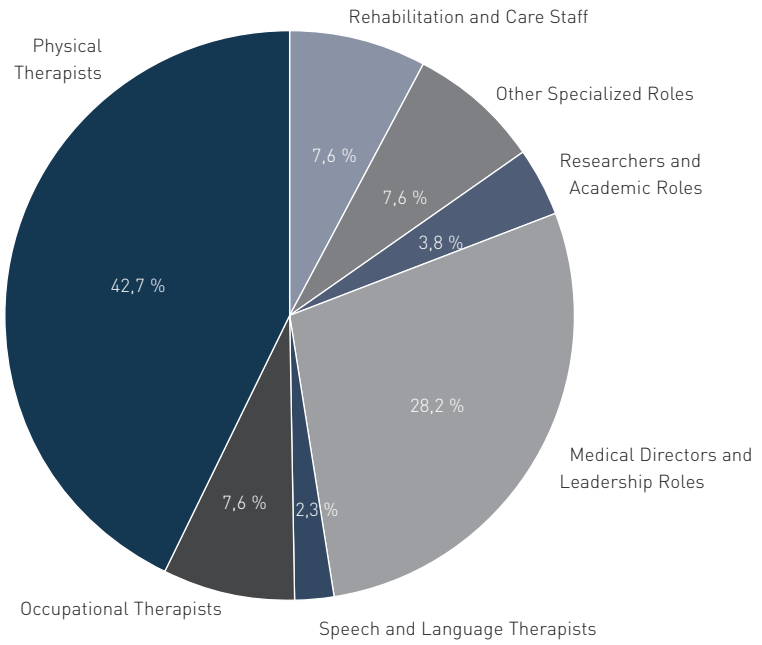
Results

A total of 429 feedback entries were collected from 175 individuals, with a median of two entries per person, providing a robust basis for evaluating the impact of THERA-Trainer devices in diverse rehabilitation settings.

The feedback originated from the two defined primary groups: patients and their relatives, who contributed 168 entries, and healthcare professionals, who provided 262 entries. Among the healthcare professionals, physical therapists accounted for the largest share with 112 entries, spanning general physiotherapy and specialized roles in neurorehabilitation and geriatric care. Medical directors and senior leaders, including department heads and clinic managers, contributed 74 entries, emphasizing the devices' strategic role in enhancing rehabilitation outcomes. Other contributions came from occupational therapists (20 entries), rehabilitation and care staff (20 entries), academic researchers (10 entries), speech and language therapists (6 entries), and professionals in niche fields such as geriatric therapy and consultancy (20 entries).

Main Group	Frequency	Description
Physical Therapists	112	Includes general physiotherapists and specialized roles in neurorehabilitation, intensive care units, and leadership positions in physiotherapy.
Occupational Therapists	20	Occupational therapists with general expertise or specialized in vegetative states and therapy sciences.
Speech and Language Therapists	6	Certified speech and language therapists, often with additional specializations.
Medical Directors and Leadership Roles	74	Includes medical directors, clinic heads, managing directors, and other senior leadership positions in therapy centers and rehabilitation facilities.
Researchers and Academic Roles	10	University researchers and academic educators involved in therapy and health sciences.
Other Specialized Roles	20	Specialist consultants, geriatric therapists, marketing/sales roles, and other niche positions.
Rehabilitation and Care Staff	20	Staff members and assistants in rehabilitation clinics, care homes, and other related facilities.

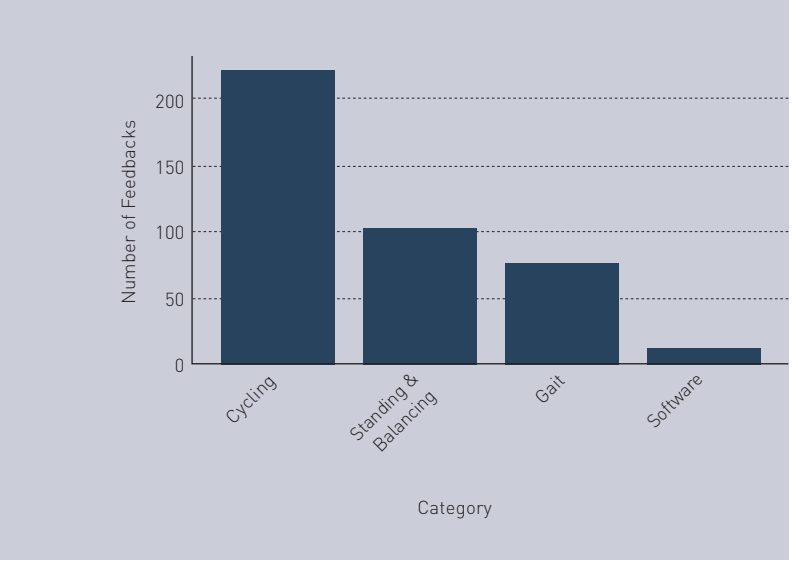
Product Groups and Application Areas
Distribution of Professional Occupations



Patients and professionals alike praise THERA-Trainer for fostering independence, motivation, and measurable progress, transforming rehabilitation journeys worldwide.

THERA-Trainer devices were widely discussed across the product categories, reflecting their versatility in rehabilitation contexts. Cycling devices overall emerged as the most frequently mentioned category, representing 52.4% of the feedback with 225 entries. These devices were highlighted for their effectiveness in physical therapy and neurological rehabilitation. Standing and balancing devices accounted for 24.2% of the feedback (104 entries), emphasizing their role in improving postural control and dynamic balance. Gait training devices comprised 18.2% of the feedback (78 entries), often praised for their value in repetitive step training and early mobilization. Software solutions, such as THERA-soft, received 2.8% of the feedback (12 entries), with users commending their biofeedback and gamification features. 10 feedback entries were excluded from this analysis as they were deemed generic.

Feedback Distrubtion Across Categories

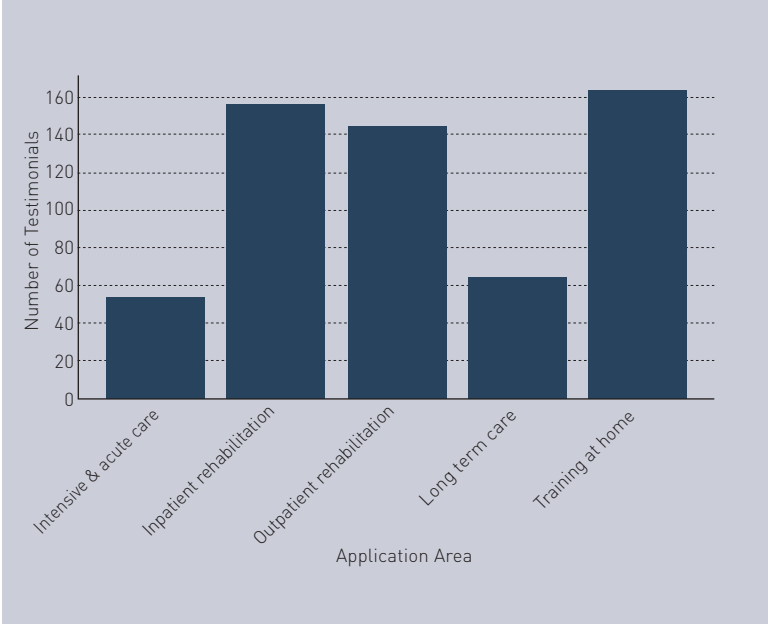


Also the customer feedback spanned various application areas, reflecting the comprehensive utility of the devices. Acute care was discussed in 54 entries, highlighting the devices' role in early mobilization and critical care support. Inpatient rehabilitation was the most frequently mentioned professional setting, with 156 entries emphasizing structured recovery programs. Outpatient rehabilitation accounted for 144 entries, underscoring the importance of continuity of care post-discharge. Care facilities, including long-term and geriatric settings, were referenced in 64 entries, while home use featured prominently with 163 entries, demonstrating the accessibility and adaptability of THERA-Trainer devices in personal environments.

Some feedback spanned multiple application areas, allowing for overlapping categorizations, as facilities often integrate various care settings such as acute care, early rehabilitation, inpatient, and outpatient services.

Testimonials Distribution Across Application Areas

Distribution Across Application Areas



The distribution of feedback across product groups and application areas showed significant variation.

Cycling devices were particularly prominent in acute care (71.2%) and home use (70.4%). In acute care settings, particularly in intensive care units, the bed cycle is a key tool for early mobilization, while cycling products are regarded as the gold standard for self-training during follow-up care and home-based rehabilitation.

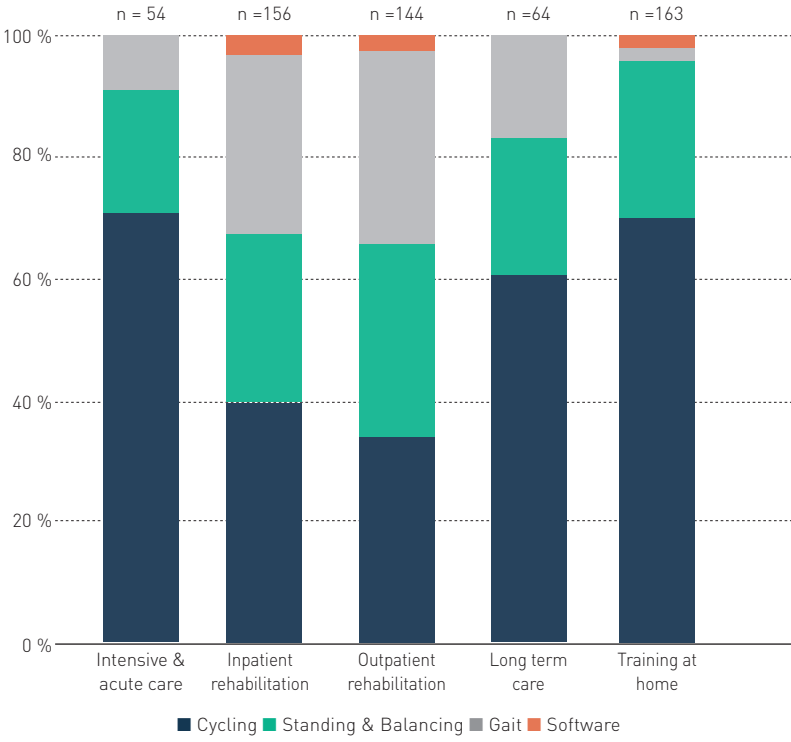
Standing and balancing devices were most frequently mentioned in inpatient (27.3%) and outpatient rehabilitation (31.6%), emphasizing their utility in improving postural stability. It is worth

noting, however, that the proportional distribution across other groups does not vary significantly. This consistency reflects the critical role of standing and balancing throughout the entire rehabilitation continuum—from early verticalization and postural control improvement to dynamic balance training for fall prevention. The data highlights that standing and balancing products are equally utilized across all rehabilitation stages.

Gait training devices were primarily discussed in inpatient (29.9%) and outpatient (31.6%) settings, where their role in structured gait recovery was particularly valued. This focus aligns with their significance during this phase of rehabilitation, especially in neurological recovery, where there is both a critical "window of opportunity" for relearning to walk and the need for a specialized setting to integrate such advanced and complex technology. Notably, gait training devices also feature in acute care and nursing settings, demonstrating their versatility in early mobilization and follow-up care.

Software solutions, though less frequently mentioned, were highlighted for their integration across application areas, particularly in inpatient and outpatient rehabilitation as well as home care. It is important to note that software at THERA-Trainer is always considered an integral component of the therapy devices and not a standalone solution. While many feedback entries included positive remarks about the software, they did not always explicitly address its features, e.g. "The toro is a cycling device that meets the needs of therapists and is easy to use. It's a joy to have a toro. Patients love the device too - especially the simple and motivating software." The feedback categorized under software here includes only those entries with specific statements about the software. For Example one clinical specialist pointed out in his feedback "Coupled with THERA-soft, a versatile, playful training software, the result is a motivating and varied training programme, a welcome change from the otherwise monotonous and mentally stressful everyday life in intensive care units. "

With feedback-driven enhancements and a user-centric design, THERA-Trainer continues to lead the rehabilitation market, setting the gold standard for recovery technology.



Cycling, Standing & Balancing, Gait, Software	Intensive & acute care	Inpatient reha-bilitation	Outpatient reha-bilitation	Long term care	Training at home
Cycling	71,2%	40,2%	34,5%	61,0%	70,4%
Standing-Balancing	20,3%	27,3%	31,6%	22,1%	25,7%
Gait	8,5%	29,9%	31,6%	16,9%	2,2%
Software	0,0%	2,6%	2,3%	0,0%	1,7%

Comprehensive Integration of Patient and Professional Perspectives

The customer feedback provides a unique synthesis of patient and professional perspectives. Patients often shared deeply personal narratives, emphasizing the emotional, physical, and social benefits of the devices. One stroke survivor shared, "Thanks to daily training at home with the THERA-Trainer, I've regained strength in my legs and can walk independently again." Similarly, a Parkinson's patient remarked, "The motorized support makes movements feel easy again and motivates me to keep going."

Professionals, on the other hand, validated these experiences more through clinical observations. A physiotherapist stated, "The lyra enables repetitive step training, essential for motor learning, with outcomes superior to traditional gait training methods." An occupational therapist emphasized the devices' impact on balance recovery, noting, "Using the balo for dynamic standing, we've seen patients regain postural control far earlier than expected."

A deep content analysis using text mining techniques and an advanced Large-Language-Model based approach identified key themes including Functionality and Versatility, Therapeutic Effects, Target Group Orientation, Emotional and Social Impact, Ergonomics and User-Friendliness, and Clinical and Individual Success Stories. The theme-specific results of this analysis are presented below.
Functionality and Versatility

The adaptability of THERA-Trainer devices is universally appreciated, with 46% of testimonials emphasizing their ability to cater to diverse patient needs and clinical contexts.

One healthcare professional emphasizes: "Modern rehabilitation technology adapted to the needs of severely affected patients, such as the THERA-Trainer tigo and the THERA-Trainer balo, offers therapists efficient possibilities for optimizing treatment concepts from intensive care units to home environments. Another healthcare professional remarked: "With the Lyra, we can start gait training early and achieve a high level of intensity, enabling effective and individualized rehabilitation in a relatively short time."

Patients also recognize the transformative impact of this versatility. One patient shared, "The versatility—whether for arm or leg training—has helped me make progress despite my limitations." Another noted, "The THERA-Trainer's ability to adapt to my needs—whether for strengthening, balance, or mobility—has made it an essential part of my recovery journey. It's empowering to train independently and see progress across different aspects of my rehabilitation."

These insights from both professionals and patients highlight the devices' ability to deliver tailored, efficient, and goal-oriented rehabilitation across the entire continuum of care.

Therapeutic Effects

Therapeutic improvements were cited in 63% of testimonials, highlighting benefits such as increased mobility, balance, and strength.

Patients frequently mentioned personal milestones. One patient explained, "After just four weeks of training with the lyra, I was able to walk six minutes at home using my walker." Another stated, "My spasticity has reduced significantly, and climbing stairs is no longer an issue."

Healthcare professionals validated these outcomes with clinical observations. An occupational therapist remarked, "Using the balo for dynamic standing, we've seen patients regain postural control far earlier than expected." Similarly, a rehabilitation specialist shared, "The lyra enables repetitive step training, essential for motor learning, with outcomes superior to traditional gait training methods." Another healthcare professional shared in this context, "The ability to customize resistance and provide high-repetition training with the THERA-Trainer devices ensures that patients can rebuild strength and endurance effectively, even in the early stages of recovery."

This alignment of personal achievements and clinical validation highlights the devices' effectiveness in addressing complex rehabilitation needs.

Target Group Orientation

Target Groups were explicitly cited in 26% of customer feedbacks showing, THERA-Trainer de-

vices cater to diverse patient populations, including those with neurological conditions (52%), geriatric patients (31%), and intensive care patients (17%).

For patients, this inclusivity means access to therapy that feels both safe and effective. A stroke patient noted, "I can highly recommend this trainer to anyone in my situation after a stroke!". Another patient reported, "My clinical picture is MS. I have limitations in all areas of daily life. The THERA-Trainer allows me to rebuild and train my muscles. My left leg, in particular, is stiff and the movement with the THERA-Trainer puts weight on it again."

Healthcare professionals value the devices' capacity to handle complex rehabilitation scenarios. One physiotherapist noted, "The balance trainer is used in our facility for patients with various neurological conditions, particularly multiple sclerosis, stroke, and Parkinson's syndromes. Patients train on the device for 25 minutes daily. Biofeedback is predominantly used, providing patients with feedback on their treatment progress, which serves as motivation." An ICU therapist highlighted the critical role of the bed trainer, "In-bed cycling trainer can make a significant contribution to successful early mobilisation in intensive care units." Similarly, a geriatric rehabilitation specialist remarked, "THERA-Trainers are very good training devices that should be used specifically for training in geriatrics." Combined with, "If the aim is to get geriatric patients walking again, the lyra is the right training device."

This broad applicability ensures that THERA-Trainer devices remain essential devices in various rehabilitation settings.

Emotional and Social Impact

37% of testimonials discussed the emotional and social benefits of using THERA-Trainer devices, with both patients and professionals emphasizing the importance of motivation and engagement.
Patients often described the emotional boost provided by the devices. One user shared, "After just a few training sessions, I felt more confident and motivated to continue. It made a huge difference in my outlook." Other patients shared in this context, "I have noticed that I am in a better mood every day since I started using the THERA-Trainer. I feel that I have better control over my urinary incontinence and can control my visits to the toilet better." and "Apart from the actual function of the THERA-Trainer, the device is already important to me today because it gives me back a piece of self-determination, even if in a simple form."

Healthcare professionals highlighted, "The emotions were positive in patients and physiotherapists after the use of the equipment." A physiotherapist summarizes after a product demo, "I hope you do the best in trying to implement the bemo in as many ICU as possible. I truly believe that it is an element that makes a difference in these patients at different levels, physical but also emotional" Another clinical expert shares his opinion on group training "Patients are highly motivated to train at their performance limits, incorporating all core elements of motor learning. We utilise this in individual and group settings, as well as in circuit training."

These observations confirm the devices' ability to foster both individual motivation as well as collective engagement and social impact.

Ergonomics and User-Friendliness

The ease of use of THERA-Trainer devices was praised in 61 % of testimonials, with both patients and professionals emphasizing their practical design.

For patients, the intuitive operation of the THERA-Trainer fosters greater independence. One user shared, "Even with severe paralysis, I can operate the THERA-Trainer on my own. It's simple and empowering." Others remarked, "It's simply fun to train because it's so easy to use." and "For me, it's extremely important that I can attach myself to the THERA-Trainer and operate it on my own - that's great!"

The minimal setup time is another key advantage, as highlighted by a patient: "The THERA-Trainer is a great change of pace—there's no setup time. I just get on and start!"

Professionals highlighted the ergonomic features of THERA-Trainer devices, which simplify clinical workflows and enhance usability. An ICU expert noted, "The bed trainer is a very ergonomic device for nurses and therapists. It is easy to use and can be customized for each patient. Accessories can be changed without tools."

A physiotherapist added, "The THERA-Trainer lyra is easy to use and enables even people with limited mobility to train successfully." Another clinical expert emphasized, "The use of THERA-Trainer equipment was straightforward; changing and fitting various auxiliary devices was simple, and the menu structure was easy to understand. Connecting patients' upper and lower limbs was effortless, thanks to the strong yet reliable fixtures."

The devices' short setup times also stood out for the professionals as a major benefit. As one professional shared, "The direct access at ground level allows even the most severely affected patients a very simple and quick transfer, reducing the time needed for preparatory measures."

These ergonomic features enhance both accessibility and efficiency, ensuring ease of use for patients and streamlining workflows for healthcare professionals.

Clinical and Individual Success Stories

17 % of testimonials included success stories, often detailing personal milestones or clinical achievements.

Specially patients frequently expressed gratitude for regaining independence. One stroke survivor shared, "Thanks to daily training at home with the THERA-Trainer, I've regained strength in my legs and can walk independently again." Another patient shared, "I am now able to pedal for 10 minutes at level 5 - 3.7 km, up from 7 minutes at level 3 - 2.7 km. I have also been able to increase my right thigh circumference from 44cm to 45cm. In comparison, my healthy left thigh measures 50 cm. For me personally, this is already a success."

Healthcare professionals echoed these sentiments with broader clinical observations. A rehabilitation specialist noted, "We've seen a 30% reduction in recovery times when incorporating the lyra into early mobilization protocols." A geriatric rehabilitation specialist summarises, "The training is suitable for preventing falls as well as for maintaining and building up muscles. As a result of the training, residents remain more mobile and therefore more independent in their daily activities." A neurorehabilitations pecialist states "With the lyra gait robot from THERA-Trainer, patients who otherwise can only walk with the support of two therapists can train their walking ability and endurance. Thanks to the gait robot, the patient achieves a multiple number of steps compared to conventional training. Early mobilization and constant repetition promote the relearning of movements."

Sentiment Analysis and Net Promoter Score

Sentiment analysis revealed that 362 feedback entries expressed strong enthusiasm, highlighting gratitude and positive experiences. The remaining 67 entries, primarily from healthcare professionals, offered more objective or neutral observations, focusing on features and measurable outcomes. This overwhelmingly positive sentiment translates to an estimated Net Promoter Score (NPS) of 84%, indicating a high likelihood of users recommending THERA-Trainer devices.

Although this score is based on sentiment analysis rather than direct quantitative surveys, the evaluation of over 400 feedback entries provides a robust indication of overall satisfaction. Notably, the absence of negative feedback further underscores the perception of THERA-Trainer devices as highly effective, user-friendly, and beneficial for both patients and healthcare professionals.

The overwhelmingly positive sentiment translates to an estimated Net Promoter Score (NPS) of 84%, indicating a high likelihood of users recommending THERA-Trainer devices.

Discussion

The analysis of customer feedback on THERA-Trainer products offers a wealth of valuable insights. The substantial volume of feedback collected represents a broad and diverse user base, highlighting the devices' widespread acceptance across various application contexts. This diversity is particularly evident in their use across settings such as acute care, rehabilitation, and home environments.

Clear patterns emerge, reflecting the devices' versatility and effectiveness. Most product groups receive substantial feedback, with the exception of the software segment, which is less frequently mentioned. However, this does not imply diminished importance. The software, as an integral component of the hardware solutions, often receives indirect praise. For instance, in the cycling category, users frequently highlight motivational and group training benefits, largely facilitated by the software. This underscores the software's essential role, even if it is not always explicitly acknowledged.

The findings reveal a predominantly positive sentiment. With 84% of feedback classified as positive, the data highlights a high level of user satisfaction. Patients frequently share personal milestones, such as regained mobility and improved quality of life, showcasing the emotional and motivational impact of the devices. In contrast, healthcare professionals often provide more objective, data-driven evaluations, emphasizing clinical effectiveness and practical usability. This mix of perspectives offers a well-rounded understanding of the devices' value.

Despite the overwhelmingly positive feedback, critical voices and suggestions for improvement are notably limited. This scarcity may stem from the nature of publicly available sources, potentially leading to a skewed representation. To address this, future analyses should incorporate systematically collected constructive feedback to ensure a more balanced perspective. Additionally, long-term effectiveness data would provide deeper insights into the sustainability of positive outcomes and identify areas for targeted improvement.

Conclusion

This systematic customer feedback analysis highlights the widespread appreciation for THERA-Trainer products, with both patients and healthcare professionals acknowledging their effectiveness, versatility, and user-friendly design. These findings confirm that the devices make a valuable contribution to improving mobility and rehabilitation outcomes. While future analyses may benefit from additional systematic input and long-term data, the overwhelmingly positive responses underscore the company's strong alignment with user needs. By continuing to build on this foundation, THERA-Trainer is well-positioned to further enhance its products and maintain its leadership in the rehabilitation technology market.

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Neurorehabilitation at the interface between theory and practice

Over the past two decades, neurorehabilitative research has conducted numerous randomised, multicentre studies on specific therapy methods. While some studies showed significant successes, particularly in regaining walking ability after a stroke, others could not demonstrate a clear superiority of new interventions compared to standard therapies. Previous and current issues of THERAPY also reported on this. The following essay summarises the author's fundamental thoughts on this subject.

Jakob Tiebel

The "negative" finding – no reason for nihilism but a catalyst for precision

That a therapeutic intervention shows no significant effect in a large, ethically well-founded study is often hastily judged a "failure". Such supposedly "negative" findings can make a valuable contribution to the acquisition of knowledge: they illustrate that a clear objective and an appropriate classification of underlying principles of interventions are key. If, for example, a specific ability such as walking speed, endurance or everyday competence is to be improved, training methods and content must have this specific focus and be carried out with sufficient intensity. Negative study results do not signal a failure of neurorehabilitation, but rather indicate potential for optimisation. They call for a more precise definition of dose-response relationships, target criteria and stronger integration of interventions into everyday care. Thus, seemingly sobering findings also contribute to the further development of more effective therapeutic approaches.

From lab to life

The clinic remains essential for diagnosis, therapy and monitoring, but limited time and staff resources make flexible, individually tailored neurorehabilitation difficult. The shift of therapeutic measures to the domestic and community-based setting is therefore becoming increasingly important. Patients can practise movement sequences in familiar surroundings – while shopping, walking or climbing the stairs at home. This enables sustainable training that can be better adapted to daily life, personal needs, rhythms and preferences.

Another advantage is that it reinforces personal responsibility and self-efficacy. If patients can integrate and adapt their training to their daily lives, this often motivates them to continue their rehabilitation. Digital technologies and therapeutic aids help them to share data with their healthcare teams, document progress and receive targeted feedback – all without face-to-face appointments.

The combination of inpatient therapy and lifeoriented rehabilitation creates a flexible, forward-looking model that better combines intensity, continuity and individualisation in neurorehabilitation. Developing tailored concepts that optimise the benefits of both approaches is critical.

Conclusion: no reason for resignation

Large-scale studies with no clinically relevant difference do not show the limitations of rehabilitation research, but emphasise the importance of dose-response relationships, target specification and environmental factors – in theory and practice. Technological innovations and combination therapies offer opportunities to increase effectiveness, while individual support sustainably improves everyday walking ability and quality of life.

In this way, a supposedly "negative" picture of the current body of evidence once again proves to be an impetus for new perspectives and innovative approaches. The challenge is to specify interventions with a view to different target groups and contexts, to make sensible use of larger data pools and to promote close integration of research and everyday clinical practice. This is the key to advancing rehabilitation research – and to sustainably strengthening the participation and autonomy of people after a stroke.

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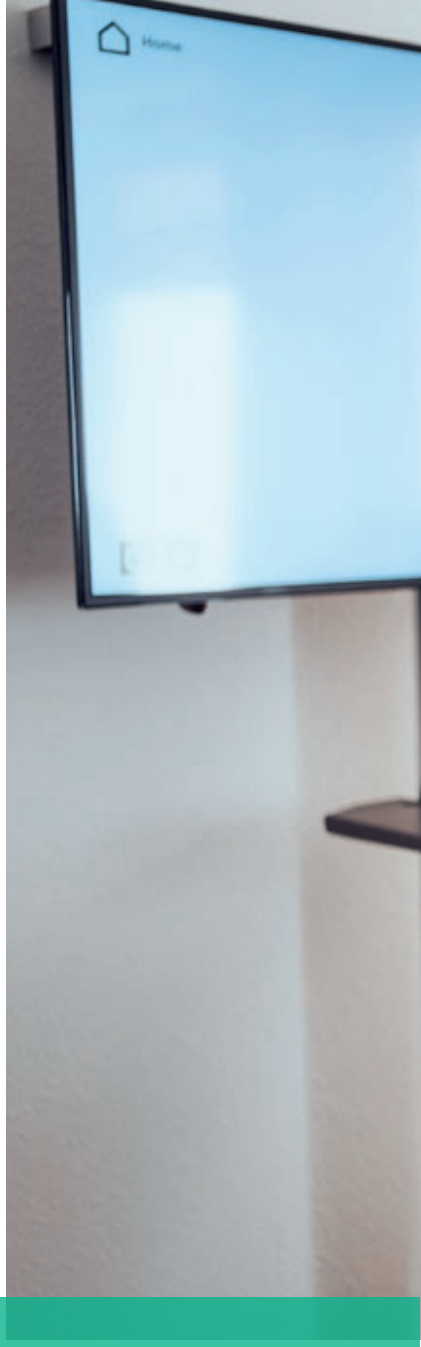
Innovation meets occupational therapy

How modern technologies complement the therapy offerings in a Neubrandenburg practice and offer clients greater self-efficacy and quality of life

Manuela Panter, Wiebke Penkuhn
Images: Reiko Zunk



Manuela Panter set up a modern occupational therapy practice in the city of Neubrandenburg. After many years of experience as an occupational therapist, teacher and founder of several practices in the region, she decided to consolidate her work at one location and link it to a new vision. Her objective: continuous care for clients – from outpatient therapy to nursing care. A unique selling point of her practice is the use of modern rehabilitation technologies. These help her clients to improve balance and core stability, thereby reducing falls and training cognitive-motor skills.

In conversation with Manuela and her colleague Wiebke Penkuhn, who joined the team as a young occupational therapist after completing her training a year ago, we take a look at the work of the practice, the challenges of daily life and the opportunities that innovative technologies offer for therapy.

When used in a therapeutically practical way, modern technologies offer great opportunities for dementia patients to enjoy their training exercises and rediscover their abilities.

Interviewer: Manuela, Wiebke, could you tell us a bit about your practice?

Manuela Panter: As an independent occupational therapy practice, we care for clients in a therapeutic centre that includes both day care and full inpatient care. We primarily care for geriatric clients, many of whom have dementia, cerebral apoplexy or other neurological symptoms. However, we also treat other clients with specific needs who come to us for treatment from outside the facility. What makes us unique is the support we provide during the transition from home care to outpatient therapy, right through to day care and full inpatient care.

Our clients benefit from a holistic approach, which specifically includes training in mobility and practical skills for everyday situations. We place a strong emphasis on modern technology-supported therapy methods and innovative approaches to sustainably improve our clients' quality of life, while also strengthening the evidence base for our work.

Wiebke Penkuhn: I'd be happy to talk about our team. After completing my training as an occupational therapist, I started working in Manuela's practice. Work here is relaxed and the team is innovative, motivated and keen to share its knowledge and expertise. The integrative work with clients in the day care facility allows us to

provide holistic care while also offering plenty of opportunities to apply modern occupational therapy approaches.

Interviewer: How did the integration of the practice into the day care facility come about?

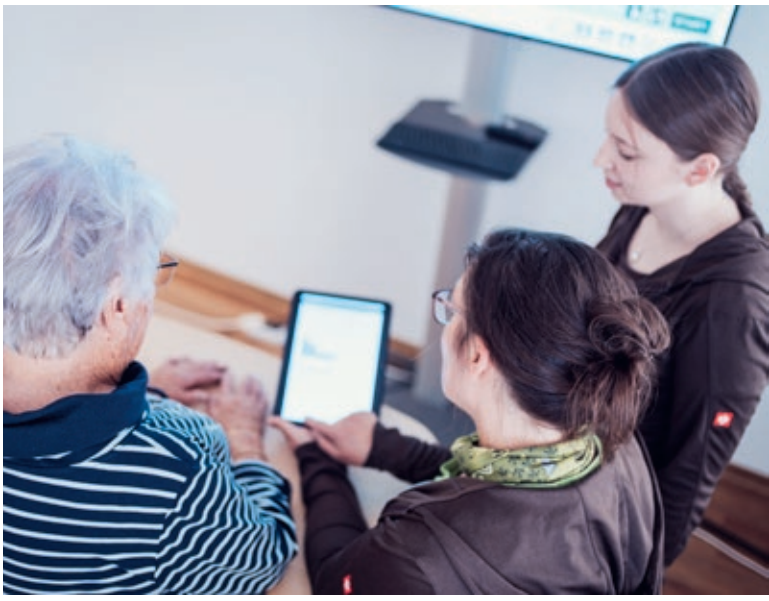
Manuela Panter: A crucial moment was when the managing director of ProPersona Care approached me to see whether we could create something together. It was a perfect fit, because he had a similar vision to me. The facility here in Neubrandenburg was still under construction at the time, and I had the opportunity to help in the design of the therapy rooms. That was a fortunate coincidence and an important foundation that allowed us to establish ourselves and grow in this way.

Wiebke Penkuhn: I wasn't personally involved in setting up the practice, so can only talk about it from today's perspective. I'm familiar with other facilities from my training and through colleagues. I'm certainly lucky and feel privileged to work in such a modern practice that offers so many possibilities and such a varied environment.

Interviewer: You place particular emphasis on modern therapeutic equipment such as the balance trainer and the THERA-Trainer senso to promote mobility and fall prevention among your clients. How do you specifically use these technologies in your practice?

Manuela Panter: We have been working with these devices for about two years now. We started with a trial phase in which we initially tried out all the technical and practical aspects. At first I was sceptical whether clients would cope with these technologies, but their positive feedback and willingness to engage quickly convinced us. Today, these devices are an integral part of our work.

We primarily use the THERA-Trainer balo to mobilise less mobile clients into a standing position and to train their postural control. It also enables us to create practice scenarios in a standing position that mimic everyday activities. We are expanding this range with the THERA-Trainer senso, which offers cognitive-motor training to promote dual-task abilities that strengthen not only motor skills but also executive functions. This is a particularly effec-



Dementia is not an exclusion criterion – the right therapy can achieve amazing results here.

tive intervention for our clients to minimise the risk of falls – particularly in situations where multiple environmental stimuli challenge their balance and spatial movement.

Wiebke Penkuhn: I think it's great that we get to work with such modern equipment in our practice. That was another aspect that excited me about the position. The many possibilities and innovative approach enrich my work greatly. With clients, I've noticed that building trust and providing a gentle introduction helps them to quickly overcome any initial concerns. For me personally, using these technologies has expanded the range of treatment options I can offer.

Interviewer: How do clients respond to the equipment?

Manuela Panter: Initially, there is some hesitation, but this usually doesn't last long. With a bit of trust and curiosity, the clients generally

respond very well to the equipment. Their initial successes – both physical and emotional – usually motivate them to keep going. It's often the case that many of them enjoy it because it boosts motivation. And that motivation is such an important resource in therapy – for both compliance and empowerment.

Wiebke Penkuhn: I regularly see clients who can stand and walk with much more confidence after therapy on the balance trainer. One client, for example, was able to train in a standing position again after a long time. This was an incredible moment for him – and for us too. Overall, the experiences have been overwhelmingly positive.

Manuela Panter: I still vividly remember one client in a wheelchair. She was able to stand on her own again after training on the balance trainer. That was such an emotional moment for her, because her mobility and body awareness had noticeably improved. Her initial scepticism gave way to a renewed confidence, and she regained a degree of independence – a success that moved us all deeply. It's a lovely feeling to see someone who is initially sceptical make such progress.

Interviewer: What challenges do you experience with clients who, for example, are living with dementia?

Manuela Panter: The integrated biofeedback features offer sophisticated cognitive and motor training options, which is what makes the equipment so valuable. What really surprised me was how positively people with dementia respond to it. I would even go so far as to say that dementia isn't necessarily a reason to exclude someone from using these technologies – quite the opposite. When used in a therapeutically practical and appropriate way, this equipment offers significant benefits for this group, allowing them to enjoy their training exercises and rediscover their abilities. Many dementia patients experience a feeling of self-efficacy, something they often miss in their daily lives when many things no longer work as they used to. Device-based therapy and interactive biofeedback create a judgement-free environment that is free from emotional baggage and often leads to a noticeable boost in motivation.

Wiebke Penkuhn: I'll admit I was initially a bit sceptical about whether some clients would be able to cope with the technology. But as soon as they realise that they can manage the exercises and that the technology provides practical support – while even motivating them in a fun way – they really start to enjoy it. The progress they make can be truly impressive.

The biofeedback features create a neutral space where clients can rediscover their abilities.

Interviewer: How viable is the concept in commercial terms and what is your vision for the future?

Manuela Panter: The practice is funded exclusively through billing for occupational therapy prescriptions. Investments in modern therapy equipment must, of course, be properly thought through, but in the long run, they pay off for us. Introducing modern therapeutic methods increases the demand for our services and brings us recognition as a specialist practice for occupational therapy – both regionally and within the professional community.

My vision is that we continue to professionalise and specialise both as a practice and as representatives of our profession. Modern, evidence-based therapeutic methods are crucial in this regard. We aim not only to set therapeutic standards, but also to sustainably improve interdisciplinary collaboration in geriatric rehabilitation and care. Our practice is increasingly developing into an open space for clients to connect and a source of inspiration for healthcare professionals.

Wiebke Penkuhn: Working in this practice offers me the unique opportunity to actively contribute to a modern and innovative concept. It goes far beyond what I learned during my occupational therapy training and in interactions with colleagues. Unfortunately, there is often a lack of time and support from manufacturers during training to explore these areas. The concept we practise here provides me with hands-on opportunities that I had previously only known in theory, so it is broadening my professional horizons.

Being part of a team that not only thinks about innovation, but lives it daily, is a great feeling!

Interviewer: Did you decide immediately after the trial phase to permanently deploy the equipment?

Manuela Panter: Yes, that was a clear-cut decision. The measurable progress and the positive feedback from our clients convinced us. At the same time, we noticed as a team that the equipment significantly expands our range of therapeutic options. The included assessments, various tasks and clear exercises provide a helpful framework – something that can guide us through the transparent presentation of results in the therapy process, supporting evidence-based therapeutic action.

It opens up new approaches, particularly in complex cases. In addition, we are experiencing an increasing demand for therapy, which motivates us to continuously think about how we can meet this growing demand in the future.

Wiebke Penkuhn: The equipment also takes some of the burden off us. For example, with the help of the standing frame, we can work safely and effectively in a standing position even with severely affected clients. Without technological support, this would involve considerably more physical effort and strain – both for the clients and for us as therapists.

Interviewer: The demand for occupational therapy and the care of older people in day care is growing. What do you think are the reasons for this?

Manuela Panter: Demographic developments are certainly a determining factor. The number of older people dependent on care and support is continuously rising, particularly in cases of degenerative diseases such as dementia.

At the same time, many residential care facilities are reaching their capacity limits, which is why alternatives such as day care are increasingly in demand. In addition, there is a growing awareness that specialised care and modern therapeutic approaches have an enormous impact on the quality of life.

Wiebke Penkuhn: I have noticed that many relatives view day care as a genuine relief, as they often can't manage the care at home on their own. At the same time, they place great importance on ensuring that their relatives receive high-quality, personalised care. The holistic view of the individual in occupational therapy, as well as the collaboration with family members, is invaluable.

What particularly impresses me is how impactful the work with clients is here, particularly those with dementia. While I learned a lot about this during my training, it's only in practice that the urgency and importance of this work in everyday life become truly tangible.

Interviewer: How do you plan to meet the increasing demand for your services while ensuring high-quality care?

Manuela Panter: We are, of course, focusing on expanding our capacities, but we place great importance on the targeted continuing professional development of our specialist team. Quality is our highest priority, which is why we also work closely with other care providers to develop our concept and integrate new approaches.

Wiebke Penkuhn: I really value the high quality standards here. Continuous development and the opportunity to learn something new motivate me and help me to successfully meet the growing demands.

Interviewer: To what extent is the use of modern therapeutic equipment taught during training?

Wiebke Penkuhn: Modern technologies currently play only a minor role in occupational therapy training and, unfortunately, are not yet standard. There is a lack of time within the curriculum and even a lack of access to the technology itself. Equipment such as the balance trainer or the THERA-Trainer senso are virtually unknown to many trainees, as they are rarely covered or used in practical training at school. It's only during internships, at facilities that use this kind of technology, that trainees get a deeper insight into their potential. To make the training future-proof, it is important

to give more weight to technological content in the curriculum and to strengthen collaboration between schools and innovative establishments.

Manuela Panter: There is definitely a need to catch up and adapt occupational therapy training to technological developments. Device-based therapy methods should become an integral part of the curriculum, not just in theory but also in practice. We as a practice create opportunities to introduce students and lecturers to the use of modern technologies through observation placements. The students can try out the equipment themselves and see how it is used in therapy situations. This not only sparks interest and understanding, but also motivates lecturers to integrate these topics more strongly into their teaching schedule. That's the only way training can keep pace with the demands of modern practice.

Interviewer: The concept is a flagship example. How do you present your establishment to the outside world? And what role does image play in your positioning as a modern and progressive establishment?

Manuela Panter: We place great emphasis on communicating our concept and vision to the outside world. This includes participating in specialist conferences where we can exchange ideas with other experts and present our model. Collaborating with regional networks and health organisations is also a key part of this, as it increases the profile of our practice and strengthens our networking. We have also established international contacts and actively exchange ideas. It's something we really enjoy and it provides us with the necessary validation.

It is impressive to see how quickly clients make progress and gain confidence through fun training exercises.

Wiebke Penkuhn: I find it exciting just how diverse the practice's public presence is. The interdisciplinary exchange in particular is incredibly enriching, because it allows us to see how our work has an impact and how it is perceived from the outside.

Interviewer: What do you both want for the future?

Manuela Panter: I would like our model to be an inspiration for other day care facilities and occupational therapy practices. Modern technologies and interprofessional collaboration should become the rule and not the exception.

Wiebke Penkuhn: I hope that many young therapists get the opportunity to work in such innovative practices. It would be amazing if the use of modern technologies became standard practice in occupational therapy.

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Manuela Panter
Occupational therapist, SI therapist, Bobath therapist, specialist therapist for dementia-related illnesses

Wiebke Penkuhn
Occupational therapist

SCIENCE

Physiotherapy: the underestimated key to a healthier society

Why the healthcare profession needs external impetus – insights from two current studies

Linda Kaiser, MSc.

Physiotherapy in Germany is at a crossroads: it could be one of the cornerstones of a modern healthcare system, yet instead it struggles with outdated structures, lack of political recognition and a system that still views prevention as a secondary concern.

The figures speak for themselves: 35.8 million physiotherapy services were provided in 2022, 254 million individual treatments took place. [1] This, however, is not because the system is functioning well, but because it intervenes far too late. Instead of preventing discomfort, physiotherapy is only prescribed when patients are already struggling with pain and no longer know when and where their problems started. This is not a future-proof approach.

The PhysioStudie 2025-2035 study and additional survey of doctors and patients by the opta data Zukunfts-Stiftung foundation show where the problems lie – and what urgently needs to change. Both studies were initiated and conducted by the opta data Zukunfts-Stiftung foundation in cooperation with the Institute for Future Psychology and Future Management at the Sigmund Freud Private University Vienna. The PhysioStudie 2025-2035 study is based on a mixed-method approach which combines qualitative interviews with over 60 experts and a quantitative survey of around 1,900 physiotherapists. The opta data Zukunfts-Stiftung study is an online survey in which a total of 116 individuals (doctors and patients) participated and which complements the PhysioStudie.

Patients want direct access but are blocked by the system

97.17% of the patients surveyed demand direct access to physiotherapy services as a health insurance benefit without the need for a doctor's prescription. This means that they want to take responsibility for their health, but the system does not allow them to do so. The hurdles are enormous:

55.26% of patients report that they had difficulties getting a prescription at all.

35.96% couldn't find a suitable practice or had to wait so long for an appointment that their condition worsened.

62.79% of the patients surveyed waited more than three weeks for their first treatment – during which time pain can become chronic.

67.39% of the physiotherapists surveyed feel that patients are assessed far too late in view of disease progression.

64.84% also believe that early physiotherapy could have avoided surgery.

In countries such as the Netherlands, Sweden or Great Britain, direct access to physiotherapy has long been a reality – with positive effects on patient care, treatment duration and costs to the healthcare system. Why is Germany clinging to outdated structures?

85.06% of the physiotherapists surveyed who participated in the online survey consider themselves professionally capable of making an adequate diagnosis. The knowledge acquired during training should be properly utilised and valued within the system. A forward-looking healthcare system should enable direct access, so that patients can be treated early, rather than suffering unnecessarily, having to resort to medication-based solutions or, in the worst case, developing chronic conditions or multimorbidity.

Prevention remains an unused potential

Another key finding of the studies is the lack of use of preventative physiotherapy measures. While physiotherapy is predominantly used for rehabilitation, disease prevention remains a marginal phenomenon – despite patient willingness to engage in preventative measures. Insurance companies and public health policy should provide incentives within this field.

97.17% of the patients surveyed demand direct access to physiotherapy services as a health insurance benefit without the need for a doctor's prescription.

86.36% of the patients surveyed stated that they would like to use preventative physiotherapy, even if they have no acute pain.

67.21% of the physiotherapists indicated that they perceive a lack of health literacy in society and that there are no social incentives to engage in prevention (59.01%).

52.45% believe that the healthcare system focuses on illness rather than on maintaining health.

65.57% see the professional mission in the role of a patient educator.

The economic advantages of preventative measures, for example in the area of back health, are substantial. According to an analysis by the German Institute of Medical Documentation and Information (DIMDI), significant savings can be achieved through workplace health management and preventative interventions. The Health Technology Assessment (HTA) 144 by DIMDI emphasises that preventative measures not only promote the health of employees, but can also increase productivity and reduce sickness absence.[2]

In addition, the report Zukunftsmarkt Prävention (Future Market Prevention) by Future-ManagementGroup AG stresses the impor--tance of preventative approaches in the healthcare system. There can be significant long-term cost savings and the efficiency of the healthcare system can be improved through the use of early interventions and health promotion.[3] More precise figures cannot be determined due to the complexity of the system. Too many interfaces are connected to physiotherapy and the underlying health issues involved in a person's recovery. However, what is certain is that a shift towards a more preventative approach could not only improve patients' quality of life, but also reduce the burden on the healthcare system in the long term.

35.8 million physiotherapy services were provided in 2022, 254 million individual treatments took place.

Digitalisation: desire for innovation

The digitalisation of physiotherapy offers great opportunities, but many patients are still reluctant to embrace it. The PhysioStudie 2025–2035 study shows that **88.52%** of physiotherapists see AI-supported treatment as a valuable addition to traditional face-to-face therapy, primarily for monitoring and intensification purposes. Modern wearables that analyse movement patterns and provide real-time feedback can personalise and optimise therapy plans. Despite these technological advances, patients remain sceptical:

77.3% of the patients surveyed rate personal contact with their physiotherapist as "very important"/"important".

Although **71.43%** of the doctors surveyed would support more intensive collaboration, implementation fails.

86.62% of the physiotherapists surveyed state that intersectoral collaboration is too limited. Day-to-day collaboration seems difficult to implement due to a lack of strategy and a common language for collaboration and shared goals.

optaVita: future skills for modern healthcare

The results of the two studies show that healthcare is undergoing a fundamental change. Digitalisation, prevention and interdisciplinary collaboration are not just buzzwords, but critical factors for the future viability of physiotherapy and other healthcare professions. But change requires not only structural reforms – it requires above all a new mindset. This is where the optaVita workshop concept comes into play. It is a future training programme for all those who want to navigate and actively participate in an increasingly complex (health) world.

Training is based on the insights of future psychology and conveys essential future skills to not only understand change processes, but to drive them forward and, above all, to avoid being left behind by the competition and continuous change.

Why future skills are crucial

We are at the dawn of an era in which healthcare professions and their clients must work in a more connected, technological and interdisciplinary manner. But what good is the best technology if there is no common language? Future skills are the key to developing not only professional competence, but also resilience and pre-resilience, flexibility and an innovative spirit. This is where optaVita steps in. For one thing is certain: the health sector is changing. The question is not whether but how we will use this change. We can shape our future – with the right skills, the right knowledge and the right attitude.

The digitalisation of physiotherapy offers great opportunities. Future skills are the key to developing not only professional competence, but also resilience and pre-resilience, flexibility and an innovative spirit.

Physiotherapy as the key to a future-proof healthcare system

The study results clearly show that physiotherapy must continue to develop as an independent healthcare profession to meet the increasing demands. Three key measures are essential:

Enable direct access: patients should be able to access physiotherapy services directly, without having to rely on a doctor's prescription.

Strengthen prevention: physiotherapy measures must be more strongly integrated into health policy planning and have financial support. Targeted use of digitalisation: technology must be deployed in a way that complements personal care and makes provision more efficient.

Physiotherapy has the potential to become a central pillar of health promotion and prevention. However, this requires political reforms, structural adjustments and a reorientation of care models. With the right strategic decisions, physiotherapy can become a critical factor for a future-proof healthcare system – in the interest of patients, physiotherapists and society as a whole.

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85.06% of the physiotherapists surveyed who participated in the online survey consider themselves professionally capable of making an adequate diagnosis.

Sources:

[1] Cf. the current figures of the National Association of Statutory Health Insurance Funds, the National Association of Statutory Health Insurance Physicians (KBV) and the Federal Statistical Office of Germany (Destatis).

[2] Cf. Rosian-Schikuta, Ingrid/Anja Laschhkolnig/Sarah Ivansits 2021: Betriebliches Gesundheitsmanagement (Corporate Health Management). Cologne: German Institute of Medical Documentation and Information (DIMDI) (= publication series Health Technology Assessment, volume 144). https://portal.dimdi.de/de/hta/hta_berichte/hta463_bericht_de.pdf [accessed on 04/02/2025].

[3] Cf. Abuschuscha, Fuád 2015: Zukunftsmarkt Prävention: Heute das Gesundheitssystem von morgen denken (Thinking about the healthcare system of tomorrow today). Eltville: FutureManagementGroup AG (= Market Foresights). https://www.futuremanagementgroup.com/wp-content/uploads/2017/01/MF_Zukunftsmarkt-Praevention.pdf [abgerufen am 04.02.2025].

Linda Kaiser learned the healthcare profession from the ground up. As a physiotherapist, she worked in neurorehabilitation for over a decade and experienced first-hand the challenges and opportunities involved in caring for patients. In doing so, she recognised that physiotherapy can not only heal, but also sustainably shape the entire healthcare system – provided it has the right framework to do so. To play an active role in shaping this framework, she expanded her knowledge about the healthcare system and, alongside her practical work, completed a bachelor's degree in Health and Social Management followed by a Master of Science in Public Health. This pathway enabled her to link theory with practice even more strongly, and to engage with the structural, political and economic challenges of physiotherapy. She now brings her professional expertise to her role as scientific director, overseeing academic management and future workshops at the opta data Zukunfts-Stiftung foundation. Here she analyses scientific studies, develops future strategies for healthcare and works with interdisciplinary teams to strengthen the future viability of the healthcare professions. In doing so, she employs the future compass, a tool developed by future psychologist Prof. Thomas Druyen, that enables systematic navigation through the challenges of the coming years.

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TECHNOLOGY & DEVELOPMENT

Medical rehabilitation in Ukraine: progress under adverse conditions

Innovative rehabilitation in times of change: how the Ukrainian city of Chernivtsi established itself as a medical centre and is finding new ways to provide patient care despite challenging conditions

Lars Timm, Jakob Tiebel

Chernivtsi, a city with a rich history and academic tradition in western Ukraine, is increasingly becoming an important centre of medical rehabilitation. The current geopolitical situation and the growing number of patients with complex injuries, particularly due to the on-going war, have significantly increased the demand for specialised rehabilitation services. In this challenging situation, the rehabilitation centre plays a key role: it offers comprehensive treatment options for people with neurological, orthopaedic and post-traumatic limitations, combining state-of-the-art medical approaches with an interdisciplinary therapy approach.

Chernivtsi is becoming an important rehabilitation centre in Ukraine.

Interdisciplinary approaches and new technologies

A highly qualified team of specialists from various disciplines works on creating individual therapy plans and implementing effective treatment concepts. In addition to traditional physiotherapeutic and occupational therapy measures, technical solutions are increasingly being integrated to make rehabilitation more targeted and efficient. At the same time, further developments in rehabilitative care present the centre with challenges – from structural and financial conditions to the training and specialisation of skilled professionals. Despite these challenges, the centre manages to

Modern technologies and interdisciplinary approaches are focused on enhancing therapy.

continuously improve the quality of care through targeted partnerships, strategic investments and the constant interaction with international experts. A look at current developments shows how the rehabilitation centre in Chernivtsi copes with the tricky balancing act between medical progress and real challenges, turning it into a pioneering institution in rehabilitative medicine.

Challenges in professional training

As the professions of physiotherapist and occupational therapist are still relatively new in Ukraine, there is a high demand for qualified specialists. Training follows the guidelines of

the Ministry of Education and comprises a four-year undergraduate course, which provides a solid theoretical and practical foundation. Following this, graduates can specialise in a two-year postgraduate course. This gives them the opportunity to acquire advanced knowledge in specific subject areas through targeted courses. While physiotherapy has steadily professionalised over recent years, occupational therapy is still developing and gaining in importance.

To meet the high demand for qualified staff and ensure practical training, the rehabilitation centre in Chernivtsi works closely with the Yuriy Fedkovych National Medical University and the Bukovinian State Medical University. This cooperation enables students to gain practical experience early on and prepare for the challenges of the profession. At the same time, both students and professionals benefit from a continuous interaction with science and research. This close networking enables the further development of modern rehabilitative approaches and the integration of innovative treatment methods into practice, thereby continuously improving the quality of rehabilitative care.

Challenges in rehabilitation

Modern device-based therapy is, of course, also playing an increasingly pivotal role in Ukraine. The scientific evidence clearly demonstrates the benefits of technology-based rehabilitation, and there is no doubt that innovative rehabilitation technologies are now an integral part of contemporary treatment approaches. Through the targeted use of modern equipment, functional progress can be more effectively promoted, therapy results objectively measured, and individualised treatment plans created.

The integration of these technologies into rehabilitative care, however, requires careful forward planning. Given the existing framework conditions, a targeted and gradual approach to investments is needed in order to utilise resources optimally and improve therapy quality on a long-time basis. New equipment is therefore carefully selected, with the focus on expanding existing treatment concepts without overwhelming the structural and financial possibilities.

Besides the acquisition of innovative systems, the training of professionals is also essential to ensure that the available technologies can be used efficiently. Since comprehensive modernisations cannot be implemented in one go, the centre concentrates on a step-by-step pragmatic approach. Proven methods are specifically combined with new approaches, technical solutions are integrated into existing processes and every advance is strategically planned. This precise and sustainable development process makes it possible to utilise modern rehabilitation technologies as effectively as possible under the circumstances and to continuously improve care.

International cooperation and support from twin cities

At the same time, Ukraine has gained valuable experience in international exchange and received significant material support during the ongoing war. New rehabilitation equipment, specialised training programmes for professionals and close collaboration with European experts have contributed to translating modern treatment approaches into practice more quickly. These developments not only enable a targeted improvement in the quality of care, but also the gradual expansion of rehabilitative structures in the country.

The twin city of Mannheim played a crucial role by supporting the establishment of a new polyclinic in the heart of Chernivtsi. Thanks to a delivery of aid from Germany, the clinic was equipped with state-of-the-art medical

The skills shortage remains one of the biggest challenges.

technology from leading European manufacturers, including the gait trainer Lyra from THERA-Trainer. In August, two specialists travelled to Chernivtsi to install and commission the equipment and to train the staff. The hospital staff were also able to participate in product training in Germany – organised by the city of Mannheim.

In the long term, this progress will contribute to further enhancing therapy quality and sustainably integrating innovative methods into everyday clinical practice. At the same time, knowledge exchange with international partners promotes the professionalisation of the rehabilitation sector and creates new perspectives for therapeutic work in Ukraine.

Current focus on the rehabilitation of military personnel

Although the rehabilitation centre also treats civilian patients, the emphasis is on treating military personnel. Since the beginning of the war, the physiotherapists have been working intensively with soldiers suffering from the consequences of mine explosions, neuropathies of the upper and lower extremities, as well as joint contractures following prolonged immobilisation and operations. In addition to the physical limitations, many patients face psychological challenges, such as anxiety and depressive disorders, apathy or occasional aggression.

Post-traumatic stress disorder (PTSD) is particularly common, requiring close interdisciplinary collaboration between physiotherapy, occupational therapy and psychology.

A comprehensive rehabilitative approach is essential to enable those affected to return to daily life in the best possible way. Modern therapeutic approaches and continuous interaction with international experts play a pivotal role in this regard. The direct knowledge transfer with rehabilitation specialists from eastern Ukraine remains a challenge, but the centre is actively working to expand networks and promote collaborations in order to share and develop experiences and proven methods in a targeted manner.

International cooperation supports medical progress.

In the current war situation, the rehabilitation work has focused mainly on specific injuries and diseases. The aftercare following operations on the musculoskeletal system requires targeted physiotherapeutic measures to promote healing and restoration of functionality. Particularly challenging are the consequences of mine explosion injuries, as complex soft tissue and bone injuries frequently occur alongside accompanying nerve or vascular damage. Another key task consists of rehabilitation after transtibial and transfemoral amputations, where adaptation to prostheses, learning new movement patterns and pain control are essential components of the therapy. Acquired mono- and polyneuropathies of the upper and lower limbs also require specialised neurophysiological treatments to restore sensory and motor functions as effectively as possible. Joint contractures resulting from prolonged immobilisation present a further challenge that is specifically addressed through individual movement therapy and manual techniques to gradually improve mobility and restore joint function.

In addition to physical rehabilitation, significant importance is placed on providing psychological support. Many soldiers face not only physical challenges, but also profound psychological ones. Therefore, holistic rehabilitation approaches are increasingly being implemented, which provide psychosocial support alongside medical care, while assisting patients throughout the reintegration process.

Significance and future of rehabilitation in Ukraine

The rehabilitation centre pursues clear long-term goals to further increase the quality of care and provide patients with the best possible support. A key concern is the successful rein-

The rehabilitation of military personnel is the current focus of attention.

tegration of military personnel into civilian life. The objective is not only to improve physical functioning through the targeted use of innovative therapeutic approaches and cutting-edge technologies, but also to promote psychological stability. The combination of individual rehabilitation, social reintegration and psychological support forms the basis for sustainable recovery.

Another important objective is the targeted expansion of specialist staff in the field of physiotherapy and occupational therapy. As the need for specialised therapists continues to grow, the centre focuses on close collaboration with academic institutions as well as targeted further training. This will ensure continuous professionalisation and enable the latest scientific findings to be directly integrated into clinical practice.

Furthermore, efforts are being made to expand the scope of rehabilitation services. The introduction of new technologies opens up additional treatment options and improves the quality of therapy. The targeted use of equipment can make rehabilitation processes even more effective and tailored to patient need. Step by step, the centre is working towards establishing itself as a leading institution for rehabilitative medicine in the region and meeting the high demands for modern, patient-centred care.

Conclusion

The rehabilitation centre in Chernivtsi performs essential work, particularly in caring for military personnel with musculoskeletal and neurological injuries. Despite challenges with regard to equipment and skills shortages, significant progress has already been achieved through international cooperation. In the long term, the focus lies on implementing inno-vative technologies and advancing the training of rehabilitation specialists to meet the increasing demand for high-quality services in this field.

Moreover, there is hope that rehabilitation services in Ukraine will no longer be determined primarily by the effects and consequences of the war. The future aim of the centre is to make a sustainable contribution to Ukrainian society as a whole, beyond its work with injured soldiers. Its long-term goal is to become a leading centre of excellence in rehabilitation, providing support to individuals from all backgrounds – whether recovering from accidents, illnesses or operations. The progress achieved despite the current challenges lays the foundation for a future where modern rehabilitation medicine becomes a vital part of the healthcare system, helping patients on their path to achieving the best possible recovery.

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Jakob Tiebel studied Applied Psychology with a focus on Healthcare Management and has clinical expertise through previous therapeutic work in neurorehabilitation. He researches and publishes on theory-practice transfer in neurorehabilitation and is the owner of Native.Health, a digital health marketing agency.

THERAPY & PRACTICE

Use of the bed bike as part of early mobilisation in the intensive care unit

A recent meta-analysis highlights the benefit

Tobias Giebler

The bed bike enables safe early mobilisation even during ventilation and when bedridden.

"Life is like riding a bicycle. To keep your balance, you must keep moving." This quote by Albert Einstein from 1930 also seems to apply to the functional principle of the critically ill human body. The cycling movement could potentially help severely ill patients regain balance.

Early mobilisation, defined as the initiation of movement within the first 72 hours, is critical [10], as it is associated with a low risk [6] and offers particularly long-term benefits [12]. The aim of early mobilisation in intensive care units is to minimise impairments following a critical illness and to restore mobility and autonomy as early as possible for an active and self-determined participation in life. It can also reduce the length of hospital stays and positively influence weaning from ventilatory support and other organ replacement procedures [11, 14].

The positive effects of early mobilisation of patients in intensive care are clearly outlined in the systematic review and meta-analysis by Wang et al [14]. Included were 39 studies with a total of 3,837 patients.

The overall results of the review show:

2.1 fewer ventilation days,
2.7 fewer days in the intensive care unit,
Hospital stay reduced by 3.7 days,
12% more muscle power,
13% more patients regain independence in terms of care.

Current scientific findings on early mobilisation

The expansion of knowledge has increased significantly in recent years driven by the publication of numerous scientific papers. Not least, the S3 guideline on Lagerungstherapie und Mobilisation von kritisch Erkrankten auf Intensivstationen (Positioning therapy and mobilisation of critically ill patients in intensive care units), published in July 2023 by the Deutsche Gesellschaft für Anasthesiologie und Intensivmedizin e.V. (DGAI) (German Society for Anaesthesiology and Intensive Care Medicine) [10], emphasises the effects and the importance of early mobilisation in intensive care units at a high level.

Challenges posed by the skills shortage

At a time of skills shortages, which have been shown to hinder early mobilisation [1], the potential of technical aids is gaining increasing attention.

The current evidence for the use of the bed bike in early mobilisation is examined in more detail below. The focus is on clinical studies and empirical findings that investigate the benefit of this method. In particular, the effects on functional outcomes, muscle preservation, cardiovascular stability and the reduction of complications, such as deconditioning or delirium, are analysed. Furthermore, possible areas of application as well as limitations and challenges in practical implementation are discussed.

Guideline recommendation over time

Whereas the most recent S2e guideline on "Positioning therapy and early mobilisation in prophylaxis or therapy of pulmonary disorders" by the DGAI [9] recommended the bed bike across a wide range of applications – from passive to resistive use – for nearly all patients, the current S3 guideline [10] takes a more cautious approach in its recommendations.

The guideline authors justify this with heterogeneous study protocols, particularly with regard to the control groups and treatment outcomes, making it currently impossible to give a clear recommendation.

As such, the new S3 guideline states: "We are currently unable to make a recommendation for the use of a bed bike as an adjunct to mobilisation." In a further passage, however, it is noted: "We suggest considering the use of a bed bike as part of early mobilisation only if functional training is not sufficiently possible." Moreover, the fundamental prioritisation remains the same: "An earlier start of therapy should be preferred over a later start, active training is preferable to passive movement therapy."

This makes it clear that the S3 guideline does not directly adopt the earlier, broader

Patients with mobility restrictions particularly benefit from the bed bike.

recommendation of the S2e guideline, but instead calls for a more differentiated assessment, in which the indication for the use of the bed bike should be determined more specifically.

Safety and areas of application

Safe feasibility is confirmed. However, close monitoring is recommended for neurologically affected patients with a risk of increased intracranial pressure [13].

Evidence of positive effects of the bed bike in the context of early mobilisation is found particularly in patients following planned cardiac surgical interventions [8]. Furthermore, studies suggest that the use of the bed bike in acute lung failure can be associated with a shorter duration of ventilation, a reduced stay in the intensive care unit and an improved functional recovery [15].

New scientific findings

In October 2024, the European Society of Intensive Care Medicine published an article on the use of the bed bike in intensive care units. The underlying systematic review and meta-analysis appeared in the prestigious New England Journal of Medicine, one of the journals with the second-highest impact factor in general and internal medicine [7].

The study entitled Leg Cycle Ergometry in Critically Ill Patients – An Updated Systematic Review and Meta-Analysis considered 33 randomised controlled trials (RCTs) from 13 countries. In total, data was analysed from 3,272 adult patients who were at least 18 years old and received care in an intensive care unit (ICU) for more than 24 hours.

Subject of investigation of the studies

Cycling as part of a multi-component intervention (n=15, 45%)

Cycling & conventional physiotherapy (n=11, 33%)
Cycling alone (n=4, 12%)

Cycling plus electrical stimulation & conventional physiotherapy (n=3, 9%)

Application methods of the bed bike

The bed bike was most commonly scheduled for use 5 times per week (n=9).

The bed bike was mostly used up to 1x daily (n=17, corresponding to 52%), closely followed by 2x daily (n=14, corresponding to 42%).

The application duration varied between 3 and 60 minutes (information available in 91% of all studies)

Positive effects of the bed bike in early mobilisation

The current meta-analysis shows that the use of the bed bike in intensive care units can potentially have positive effects on functional recovery and length of hospital stay.

Physical function at discharge from the intensive care unit: The use of the bed bike probably improves physical function upon discharge from the ICU (12 RCTs, 1,291 patients; SMD 0.33; 95% CI 0.05 to 0.62; low evidence). The assessment was conducted using established measurement tools such as the Physical Function in ICU Test (PFIT), the ICU Mobility Scale (IMS) and the Functional Status Score for the Intensive Care Unit (FSS-ICU).

Physical function upon discharge from hospital: There is evidence to suggest that the bed bike probably also improves physical function at hospital discharge (8 RCTs, 865 patients; SMD 0.23; 95% CI 0.04 to 0.42; low evidence). Here, in addition to the PFIT, the 6-minute or 2-minute walk test as well as the 36-Item Short-Form Health Survey (SF-36) were also used.

Reduction in length of stay in the intensive care unit: The use of the bed bike may potentially reduce the length of stay in the ICU by an average of 1.06 days (29 RCTs, 2,575 patients; 95% CI 0.33 to 1.80 fewer days; low evidence).

Reduction in hospital length of stay: Similarly, the analysis suggests that the total hospital length of stay can likely be reduced by 1.48 days (22 RCTs, 2,060 patients; 95% CI 0.47 to 2.49 fewer days; moderate evidence).

Muscle power at hospital discharge: The use of the bed bike could increase muscle power at discharge (5 RCTs, 500 patients; SMD 0.40; 95% CI -0.06 to 0.86; low evidence), although the results still show uncertainties here.

Despite positive studies, implementation in hospitals is often slow.

Safety and adverse events: The pooled rate of adverse events in the intervention group was only 1% (11 RCTs, 4,623 sessions; 95% CI 0 to 2%; low evidence), suggesting that the bed bike could be a safe tool in the context of early mobilisation.

The minimal time required for an exercise session with the bed bike is highlighted, as well as the possibility of beginning training while bedridden, under sedation and during ventilation.

These results highlight the potential of the bed bike as a supportive measure to promote functional recovery in the intensive care unit, while the body of evidence for some endpoints remains limited.

An effect on the occurrence of intensive care unit-acquired weakness (ICUAW) as well as on mortality in the intensive care unit or in hospital

Its use can reduce the length of stay in the intensive care unit and in hospital.

could not be demonstrated. The authors point out that the quality of the underlying evidence and the methodological heterogeneity of the evaluated studies limit the validity of the results.

Discussion about the practical significance and possible applications

The use of a bed bike holds potential for early mobilisation in the intensive care unit, particularly for patients with limited autonomous activity or reduced ability to engage in contact, which makes active participation in therapy more difficult. In these cases, the possibilities for early mobilisation are often limited, and the bed bike can be a suitable measure in the therapy concept.

According to current knowledge, the presence of an endotracheal ventilation tube mentioned in the meta-analysis does not present a barrier to early mobilisation from the bed. The feasibility and safety of this measure have been established for some time [2,4,6]. Nevertheless, implementation in clinical practice lags behind scientific findings, and mechanical ventilation continues to be viewed as a barrier to early mobilisation [3,4,5].

In addition to the scientific findings, there are positive experiences from clinical practice. Patients with painful changes in the lower extremities, for example in connection with severe oedema or intensive care unit-acquired weakness (ICUAW), report that movement with the bed bike is perceived as a pleasant experience and can also contribute to pain relief.

Observations from daily clinical practice indicate that the use of the bed bike promotes the recovery of stable circulatory regulation and can support the weaning process from cardiovascular-acting medications.

Obese patients in particular benefit significantly from the bed bike. In addition to the positive effects on the cardiovascular system and thrombosis prophylaxis, the bed bike enables effective contracture prophylaxis and the preservation of joint structures, since passive manual movement in this patient group is often only possible to a limited extent or not at all.

Another advantage lies in the minimal time required in relation to the potential benefit. The total time required for a training session – including setup, removal and cleaning – is 15 to 20 minutes. During the training session itself, only supervision and, if necessary, motivation are required, enabling the healthcare professional to prepare additional mobilisation measures or complete documentation tasks. The use of the bed bike can therefore help alleviate staff shortages or free up additional training sessions throughout the day.

Conclusion

Although the current S3 guideline on positioning therapy and mobilisation [10] does not provide a comprehensive recommendation for the use of the bed bike as part of early mobilisation, the results of the current meta-analysis [7] as well as practical experience provide arguments for its integration as a component of early mobilisation. Its use is of particular interest in situations where assistive or active participation in therapy is not possible and other early mobilisation measures cannot yet be implemented.

More about this topic in the webinar with Tobias Giebler

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The comparatively minimal time required for a therapy session, the very low safety risk, as well as initial indications of positive effects regarding functional improvements and a potential reduction in the length of stay, make the use of the bed bike attractive for both patients and hospitals. Moreover, an implementation could bring economic benefits for the healthcare system.

The minimal time required makes it an effective adjunct to mobilisation.

In order to enable well-founded recommendations for the clinical use of the bed bike as a component of early mobilisation, further studies with standardised protocols are required.

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Tobias Giebler graduated as a physiotherapist at the University Hospital of Freiburg in 2013. For the past 11 years, he has been working on early mobilisation at the TherapieZentrum, University Hospital Tübingen. After one and a half years in an interim position, he has been a specialist in the fields of intensive care medicine and neurosurgery since 2023.

TECHNOLOGY & DEVELOPMENT

Review: DGNR Congress 2024

Neurorehabilitation – progress, perspectives and future directions

Jakob Tiebel

The key theme of the DGNR Congress 2024, held from 6 to 8 December in Düsseldorf, focused on shaping the future of neurorehabilitation. Leading experts from medicine, therapy, science and politics came together to discuss groundbreaking developments and the challenges of the coming years.

Key themes and future directions

In this and the coming years, decisions will be made that will significantly influence the future development of neurorehabilitation. The congress focused on two key points, which served as a unifying theme:

Health policy and hospital planning

The strategic reorientation of hospital planning is expected to have significant implications for neurorehabilitation in Germany. Decisions made in the coming years will affect not only the early rehabilitation of patients with neuro--logical diseases or the weaning from ventilators in hospitals, but also the organisation and quality of all subsequent rehabilitation phases.

Forward-thinking decisions shape the organisation and quality of neurorehabilitation.

The participants at the congress emphasised that these changes could have far-reaching consequences for the entire rehabilitation process – from inpatient care to outpatient and non-clinical services. Political decisions in areas such as resource allocation, personnel planning and infrastructure will play a crucial role in how patients gain access to specialised rehabilitation and how their care is structured in the long term.

A key area of discussion was how these developments can be actively shaped to ensure that high-quality, effective and patient-centred rehabilitation services remain guaranteed, even within a changed care system. It became clear that close cooperation between political decision-makers, medical professionals and healthcare facilities is essential to develop future-proof solutions.

These discussions highlighted the fact that Germany is at a critical juncture, where the groundwork for the future of neurorehabilitation is being laid – potentially influencing not only the national healthcare system but also extending its impact far beyond it.

Technological innovations

Technologies such as virtual reality (VR), neurorobotics, digital health applications and artificial intelligence (AI) are rapidly changing the landscape of neurorehabilitation. These innovations open up fascinating possibilities: VR enables immersive training environments that motivate patients and promote neuroplasticity. Neurorobotics provide precise movement assistance and feedback for motor rehabilitation. Digital health applications and rehabilitation apps make therapies accessible regardless of time and place, while enabling patients to train independently at home. AI-based diagnostics and therapy adaptation can further improve the efficiency and effectiveness of treatment plans.

What role will rehabilitation facilities play in the future? While rehabilitation apps and digital solutions offer flexible access, it remains unclear whether they can fully meet the complex requirements of many patients. For severely affected patients, personal care and interdisciplinary collaboration in inpatient facilities may continue to be essential.

How will the technology be integrated into existing systems? New technologies require not only investments, but also adjustments to infrastructure and staff training.

Will these innovations be accessible to all patients? The discussion about digital health solutions raises questions of equal opportunities and accessibility, particularly for elderly or less tech-savvy patients.

The future of neurorehabilitation will likely be a hybrid combination of technology and personal care. Digital applications can complement therapeutic offerings, but cannot completely replace them – particularly in complex cases that require an interdisciplinary approach. It also became evident that close collaboration between research and practice is essential for the effective and sustainable integration of these technologies into the care setting.

Neurorehabilitation therefore faces an exciting challenge: striking the right balance between technological advancement and human-centred care to deliver the best possible treatment for patients.

Highlights and discussions

The presentations and workshops provided valuable insights into the latest research findings and their practical application. Particularly exciting was the question about the future of inpatient rehabilitation facilities and how they can be integrated with digital offerings.

Companies showcased their latest technologies and devices, including VR systems, AI-supported diagnostics and robot-assisted training equipment, at the accompanying trade exhibition. Many of these innovations were also presented at the trade exhibition, and critically discussed in the workshops and presentations.

These presentations emphasised how closely the future of neurorehabilitation is linked to innovative technologies, personalised approaches and evidence-based care. They demonstrated how research and practice can work together to sustainably improve the quality of life of patients.

Robot-assisted therapeutic procedures: trends and challenges

Jakob Tiebel gave a comprehensive overview of the use of modern computer and robot-assisted therapy methods in neurorehabilitation in a state-of-the-art presentation for the expert committee on neurology of the German Association of Occupational Therapy. In addition to the body of evidence, challenges in practical implementation were highlighted – in each case on the basis of underlying principles of action. He provided an overview of the current state of neurorehabilitation and his outlook on trends, such as personalised robotics and virtual training methods that will influence and shape therapy in the future.

Wide range of robotic systems: targeted use

Stefanie Fischer from Bad Homburg discussed the increasingly wide range of robotic systems and raised the issue of which technology is most suitable for which patient. She emphasised that the key to success lies in setting precise goals and adapting the equipment to individual circumstances. Quality assurance standards and training are also essential for therapists, she explained.

Structured approaches to gait training

Sabine Lamprecht presented structured approaches for effective gait training geared towards the individual abilities and personal goals of patients. Various options were presented, from treadmill therapy to home visits with targeted balance training. She also initiated a discussion on the role of postural control and the importance of balance training in later rehabilitation phases.

Digital technologies extend the possibilities, but require hybrid care solutions.

End-effector controlled gait training for severe neglect

Prof. Gorsler and her colleagues from Brandenburg emphasised in their presentation how early end-effector controlled gait training can improve walking ability in patients with severe neglect. Progress in trunk stability and balance was discernible, particularly in severely affected patients.

S3 guideline on therapy of mobility after stroke

The focus of the presentation by Unger and Dohle (Witten/Berlin) was the S3 guideline on therapy of mobility after stroke (TheMoS), which, in addition to therapy recommendations, is likely to provide concrete implementation concepts for clinical practice in the future. The authors showed that the dissemination and use of evidence-based guidelines in practice is often inadequate. The approaches to implementation that they presented emphasised the need for specific strategies and tools to make the guidelines applicable for therapists, patients and other healthcare actors. The results of a systematic literature review on implementation concepts reinforced the importance of such approaches and provided practical solutions to sustainably improve stroke care. The researchers indicated that, in line with the current ReMoS guideline, a digital version of the guideline should also be made available again. The results and the publication are expected in early 2026.

Sustainability and outlook

The DGNR Congress 2024 was not only a platform for experts to meet and discuss, but also a clarion call to actively shape the future of rehabilitation. We don't just want to inform, we also want to make an impact and pave the way for patient-centred, innovative and sustainable neurorehabilitation, the organisation team was keen to stress.

Conclusion and outlook

The congress amply demonstrated that neurorehabilitation faces exciting yet complex challenges. The choices and decisions made today have the potential to fundamentally change care in the coming decades. The DGNR Congress continues to be an essential platform for anyone looking to actively shape the future. It serves as a space for forward-thinking discussions on the synergies between politics, technology and patient-centred care.

Save the date for 2025 to continue the discussion and discover more innovations!

Joint Annual Meeting of DGNR e.V., OeGNR and SGNR

4 December – 6 December 2025
Freiburg, Baden-Württemberg, Germany

The Joint Annual Meeting of the German Society for Neurorehabilitation (DGNR) together with the Austrian Society of Neurorehabilitation (OeGNR) and the Swiss Society of Neurorehabilitation (SGNR) will take place from 4 December – 6 December 2025 in Freiburg. Under the heading: Evidence, Practice and Innovation.

Further information at https://www.dgnr.de

Jakob Tiebel studied Applied Psychology with a focus on Healthcare Management and has clinical expertise through previous therapeutic work in neurorehabilitation. He researches and publishes on theory-practice transfer in neurorehabilitation and is the owner of Native.Health, a digital health marketing agency.

Intensive robot-assisted neurological rehabilitation

How modern robotics-supported technologies support people with neurological impairments in outpatient aftercare

Sarah Daniel

In September 2024, experts from around the world immersed themselves in an inspiring online session on the future of neurological rehabilitation. The THERA-Trainer webinar with Sarah Daniel, MSc, founder and therapeutic director of MOTIONrehab®, presented a fascinating and practical introduction to the use of cutting-edge robotics-supported technologies in neurorehabilitation.

The future of neurorehabilitation

With over a decade of experience in outpatient neurological intensive therapy, Sarah Daniel provided a very interesting insight into the innovative approaches of MOTIONrehab®. Her presentation centred on one key question: How can technological advances overcome the boundaries of traditional rehabilitation? Answer: Through the targeted use of robotics-supported and sensor-based therapy devices, patients can receive personalised, intensive and effective motor therapies that are often not feasible in traditional outpatient settings.

One key focus was the scientific evidence demonstrating the positive effect of intensive, repetitive movement patterns in neurorehabilitation. In her presentation, she impressively demonstrated how innovative technologies accelerate motor learning, promote brain plasticity and ultimately optimise the functional progress of patients. She repeatedly referred to the recommendations of international guidelines.

From theory to practice: success models and challenges

The discussion about how modern rehabilitation technologies can be successfully integrated into existing treatment concepts was particularly exciting. Using real case studies, Daniel demonstrated how MOTIONrehab® tailors the therapeutic approach to the needs of patients.

Yet with technological innovation come economic challenges too. A key theme of the webinar was therefore the question of how a cost-effi-

cient implementation of robotics-supported rehabilitation might look in healthcare systems with limited resources. The participants received valuable insights on how to reconcile quality and cost-effectiveness without compromising patient care.

Interactive Q&A – a glimpse into the work of experts

The concluding Q&A session featured insightful and practical questions from the participants. The lively discussion highlighted the significant interest in these innovative methods, ranging from the use of robotics-supported systems in diverse clinical and non-clinical settings to tangible therapeutic successes.

Conclusion: a milestone for neurological rehabilitation

The THERA-Trainer webinar has once again amply demonstrated what the future of neurorehabilitation could look like. Tailored, technology-supported therapeutic approaches are unlocking entirely new possibilities for patients with neurological impairments.

A recording of the webinar is available if you missed it or if you would like to explore the topic further.

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Sarah Daniel is the owner and director of MOTIONrehab. In 2001, she completed her education at St. George's Medical School in London with a first class honours degree. She completed her Master's degree in neurological physiotherapy at Coventry University with a merit. In April 2018, Sarah Daniel opened the UK's first intensive outpatient neurological rehabilitation facility in Leeds, where she also works with robotics and VR technology.

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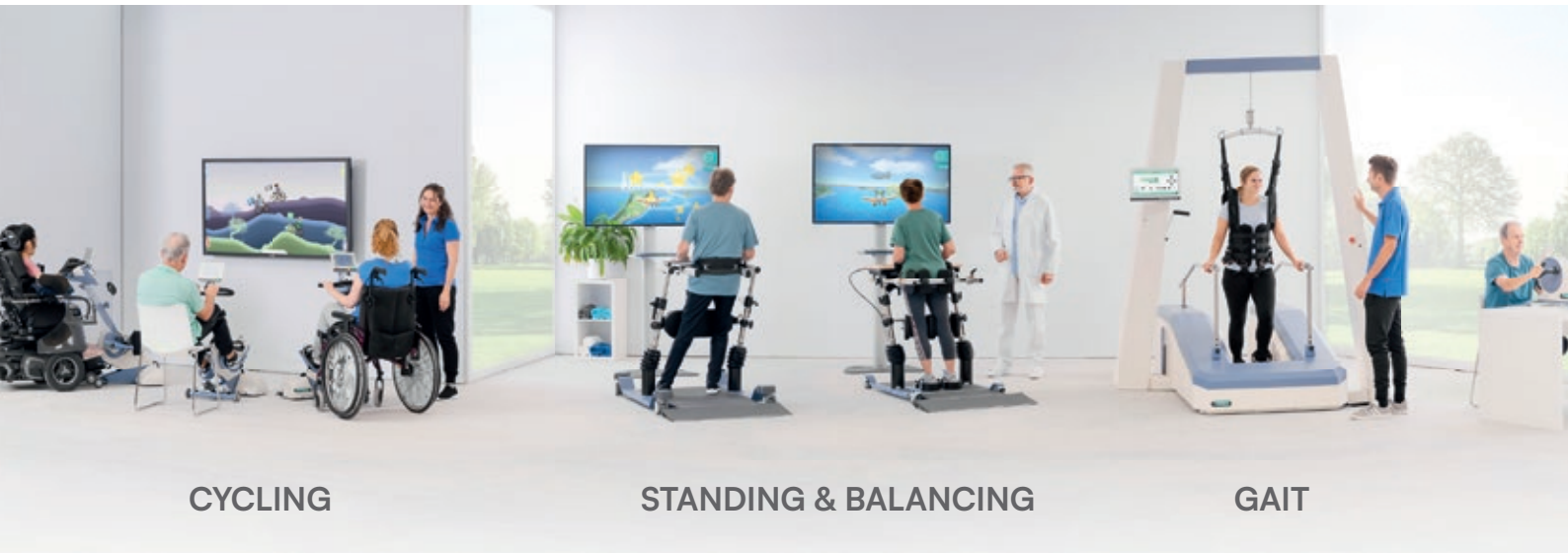

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Issue No. 01/2025 | 16th Edition | Volume 8

Publisher & media owner: THERA-Trainer by medica Medizintechnik GmbH | Blumenweg 8 | 88454 Hochdorf

Photo credits: Adobe Stock, Reiko Zunk, Passauer Wolf Reha-Zentrum Bad Griesbach, Leipziger Messe, Conventus, MOTIONrehab

Sales: The magazine is published twice a year and is free

A009-498 | 04/2025