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Development and Results of an Implementation Plan for High-Intensity Gait Training

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Background and Purpose: High-intensity gait training is recommended in stroke rehabilitation to improve gait speed, walking distance, and balance. However, identifying effective and efficient implementation methods is a challenge for rehabilitation providers. This article describes the development of an implementation plan, presents findings of each implementation phase, and identifies the project's impact on clinicians and the health system.

Methods: Two inpatient rehabilitation facilities, including 9 physical therapists, collaborated with a knowledge translation center to implement this program. We developed an implementation plan using the Knowledge-to-Action Framework and utilized the Consolidated Framework for Implementation Research to identify barriers and select implementation strategies. Using mix-methods research, including surveys and informal discussions, we evaluated current practice, barriers, outcomes, and the sustainability of high-intensity gait training in practice.

Results: A multicomponent implementation plan that targeted barriers was developed. Before implementation, clinicians reported providing several balance, strength training, and gait interventions to improve walking. Barriers to using high-intensity gait training included knowledge, beliefs, adaptability of high-intensity gait training, resources, culture, and others. Twenty-six implementation strategies were selected to target the barriers. Surveys and informal discussions identified significant changes in perceived practice, adoption of high-intensity gait training, and positive impacts on the health system. The 2-year follow-up survey indicated that the new practice was sustained.

Discussion and Conclusions: Using a multicomponent implementation plan that targeted barriers, we successfully implemented high-intensity gait training in clinical practice. Contributors to successful implementation may include the implementation methods, usual care interventions, and clinicians' readiness for this change.

Video Abstract available for more insights from the authors (see the Video, Supplemental Digital Content 1, available at: http://links.lww.com/JNPT/A352.)

Key words: *gait training, implementation, knowledge translation, rehabilitation, stroke*

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INTRODUCTION

Identifying effective and efficient implementation methods is a challenge for health care providers.[1] Many efforts focus on publishing systematic reviews, meta-analyses, and guidelines to facilitate research use, although a recent systematic review suggested clinicians did not use recommendations approximately two-thirds of the time despite awareness of and agreement with guidelines.[2] This failed phase in the publication, dissemination, and implementation pipeline suggests that patients may not benefit from the advances in research.

In stroke rehabilitation, research continues to identify gaps between the evidence and clinical practice.[3-6] In gait rehabilitation, studies describe the substantial impact of walking

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interventions characterized by high amounts of stepping and high aerobic (ie, cardiovascular) intensities. Studies assessing these interventions demonstrate substantially improved walking speed, endurance, and walking economy for individuals poststroke.[4,7-10] Specifically, walking training provided at 60% to 80% of predicted heart rate (HR) reserve can result in 2000 to 6000 steps per physical therapy session,[4,7,11,12] and previous studies indicate a correlation between this "dose" of stepping practice and improvements in walking outcomes (ie, response).[4,11,13,14] Furthermore, a recently published clinical practice guideline on locomotor strategies strongly recommended use of moderate- to high-intensity gait training for patients with diagnoses impacting the central nervous system.[15]

While this evidence supports the clinical translation of high-intensity training (HIT) focused on stepping practice, the utilization of this intervention in clinical rehabilitation is limited. Stroke rehabilitation for gait often includes many interventions and tasks while achieving only approximately 250 steps per session during inpatient rehabilitation.[3,4,16] Furthermore, aerobic exercise thresholds are reached for less than 5% of sessions,[6] with an average HR of 30% to 40% age-predicted HR reserve throughout sessions.[6]

Knowledge translation (KT) research aims to identify methods to increase the efficiency and effectiveness of implementing evidence into practice. Knowledge translation is the dynamic and iterative process that includes synthesis, dissemination, exchange, and ethically sound application of knowledge to improve health, provide more effective health services and products, and strengthen the health care system.[17] The Knowledge-to-Action (KTA) framework is commonly used in the field of rehabilitation.[18,19] This framework includes the knowledge creation funnel, which includes funneling primary and synthesized research to a consumer-friendly knowledge tool. The second component of the KTA is the action cycle that includes 7 iterative phases to implement evidence into clinical practice.[20,21] The phases include selecting knowledge and identifying knowledge gaps; adapting knowledge to the local context; assessing barriers and facilitators to knowledge use; selecting, tailoring, and implementing KT interventions; monitoring knowledge use; evaluating outcomes; and sustaining knowledge use.[21]

Using the KTA cycle, we implemented a HIT program in 2 inpatient rehabilitation units in Oslo, Norway.[22] In this quasi-experimental study, we assessed stepping activity, walking, and balance outcomes during usual care ($n = 56$). After using the KTA cycle to implement HIT, we collected and compared data from patients in the postimplementation phase ($n = 54$). Following the implementation of the program, average steps per day (5777 ± 2784) was significantly greater than during usual care (3917 ± 2656, $P < 0.001$). We observed improvements in self-selected gait speed (0.39 ± 0.28 vs 0.16 ± 0.26 m/s) and fastest gait speed (0.47 ± 0.41 vs 0.17 ± 0.38 m/s, both $P < 0.001$). High-intensity training also resulted in significantly greater gains in Berg Balance Scale (BBS) and 6 minute walk test (6MWT) compared with usual care. Steps per day was a primary predictor of improved walking capacity.

This article describes the use of the KTA cycle and a multicomponent KT intervention to implement HIT successfully. While we published the functional outcomes of patients separately,[22] the purpose of this article is 3-fold: (1) to describe the development of a KT plan using the KTA cycle; (2) to present findings of each phase in the action cycle; and (3) to describe the impact of the HIT on clinicians and the health system.

METHODS

The Regional Center of Knowledge Translation in Rehabilitation (RKR, Oslo, Norway) initiated this project. We invited a scientist and a HIT expert from the United States to educate clinicians about the intervention. After learning about the effectiveness of HIT, these clinicians evaluated the evidence, discussed the program with administrators, and examined the potential risks and benefits of participating. After approximately 1 year of discussions, the clinicians collectively agreed to implement a gait assessment battery and the HIT program. The project was led by a Norwegian project manager and a KT expert from the United States who provided KT guidance (ie, external facilitation). Meetings between the project managers, clinical team, and researchers occurred primarily using online video conferences, with in-person trainings on assessments and HIT.

Setting

We conducted this project in 2 institutions colocated in one building, including the Oslo University Hospital (OUH), a specialized rehabilitation unit, and Oslo Municipality Services (OMS), an enhanced rehabilitation unit within the Oslo primary health service. At the time of the project, the OUH admitted an average of 160 patients with stroke annually, with an average length of stay of approximately 20 days. Staffing at OUH included 3 physiotherapists (PTs; 2.5 full-time positions). The OMS admitted approximately 70 patients with stroke annually, and the average length of stay was approximately 21 days. Staffing included 6 PTs (5.0 full-time positions) who also served other diagnostic groups. Patients must require services from more than 1 rehabilitation specialty to qualify for services, but patients at OUH must require services available only at a specialty hospital.

Development of the KT Plan

We used the KTA framework to guide the KT plan and implementation of HIT. Two principles guided our implementation planning, including repeating KTA phases and engaging stakeholders throughout the project. During implementation, results from the early phases of the KTA cycle informed later-phase activities. Therefore, the methods include activities performed in each of the KTA phases. The results include the information learned from each of the KTA phases. Table 1 describes the KTA plan.

Phase 1: Identify the Problem, Assess Know-Do Gap, and Select Knowledge

To characterize current practice and culture, we administered a gait training survey that included modified versions of a previously published survey.[23,24] We also administered the Organizational Readiness to Implement Change (ORIC)[25]

Table 1. KTA Plan and Results

KTA Phase	Methods for Each Phase	Results
Phase 1: Identify problem, determine the Know-Do Gap, identify, review, and select knowledge	• Conducted a survey on perceptions, barriers, and facilitators related to HIT • Informal interviews with clinicians and managers • Reviewed evidence and selected a specific HIT for implementation	• Current practice described as including several interventions to address gait-related impairments (see Table 3) • Selected HIT protocol as described in the study by Holleran et al[11]
Phase 2: Adapt knowledge to local context	• Reviewed current evidence and doses of HIT • Adaptation of the research protocol to fit into local context. Recommendations for adaptations made by clinicians, administrators, and researchers	• Local adaptations for HIT (frequency, intensity and HR calculations, time and type) • Translated and adapted data collection forms • Adjusted inclusion/exclusion criteria
Phase 3: Assess barriers and facilitators to knowledge use	• Survey to clinicians on perceptions, barriers, and facilitators to HIT, and Organizational Readiness to Implement Change[25] • Informal interviews with clinicians and managers • An iterative process of barrier and facilitator assessment, implementation of KT intervention, and monitoring	• Barriers included intervention adaptability and cost, available resources, compatibility, culture, individual stage of change, and knowledge and beliefs (Table 4)
Phase 4: Select, tailor, implement KT interventions	• Barriers were categorized according to the CFIR and KT interventions were selected • Design of KT interventions codeveloped by the clinician and research teams	• A multicomponent KT intervention was delivered that included educational interventions, accessing funding, changing physical structure and equipment, promoting adaptability of HIT, conducting local consensus discussions, and others (Table 4 and Appendix 3)
Phase 5: Monitor knowledge use	• Clinicians completed current practice survey ∼9 mo after implementation of HIT • Collected stepping activity and amount of time in the HR/RPE zone • Informally reviewed treatments weekly during group meeting	• Survey results indicated increased prioritization of HIT over other interventions, improved HIT skills in delivering and describing HIT, and increased understanding of gait-related prognosis and HIT decision making • Stepping and HR monitoring indicated compliance with HIT recommendations
Phase 6: Evaluate outcomes	• Provider level: Surveys of clinician attitudes, perceptions, and perceived adherence to recommendations • Patient level: Functional outcomes[22] and patient survey • Organizational level: Surveys and informal discussions	• Provider level: Significant decrease in the number interventions that were not task-specific from 2017 to 2019 (Table 5) • Patient level: Improved functional outcomes with HIT[22] and patient perceptions indicated that they were satisfied with HIT (Figure 1) • Organizational level: Obtained health system goal of improving coordination and cooperation between primary and specialty care
Phase 7: Sustain knowledge use	• The team codeveloped the sustainability plan. They utilized standard processes in the hospitals when possible. Plan consisted of weekly meetings about HIT, creating a local guideline, developed training processes for new staff, and training for clinicians in Norway to increase awareness of HIT. • Assessed sustainability with a follow-up survey	• Follow-up survey indicated no significant changes in perceived practice with exception of decreased amount of time performing standing balance activities with patients who require maximum assist

Abbreviations: CFIR, Consolidated Framework for Implementation Research; HIT, high-intensity training; HR, heart rate; KT, knowledge translation; KTA, Knowledge-to-Action; RPE, ratings of perceived exertion.

to understand potential organizational influences on the implementation of HIT. Surveys were distributed 3 times, including before and after implementation of HIT and a 2-year follow-up. The researchers conducted discussions with PTs and administrators at each clinical site to discuss current practice, barriers, and facilitators to using HIT (see Supplemental Digital Content Appendix 1, available at: http://links.lww.com/JNPT/A353. Interview Guide). These discussions occurred at the beginning of the project and after online training and on-site training. Managers also participated in informal interviews at the beginning of the project. To characterize current practice, the clinicians collected patient stepping activity and functional outcomes, which were published in 2020.[22]

Phase 2: Adapt to the Local Context

When implementing HIT in clinical practice, it is crucial to use the intervention similarly to how it was studied. After completing education and training on the gait assessments and HIT, the external facilitator reviewed the measures used in research, critical components of HIT (ie, overground, treadmill, and stair climbing), and doses studied with the clinical team. Collaboratively, the group identified the adaptations needed to integrate HIT into the local context.

Phase 3: Assess Barriers and Facilitators

We collected information about barriers and facilitators in the surveys and interviews (see phase 1, *Phase 1: Identify the problem, assess know-do gap, select knowledge*). An ongoing and iterative process of barrier identification occurred during the early phases of implementation. We monitored adherence as we implemented HIT, and we reassessed barriers when fidelity of the intervention was less than desired. The barriers were categorized using the Consolidated Framework for Implementation Research (CFIR).[26] A description of the

CFIR domains with definitions is available in Supplemental Digital Content Appendix 2, http://links.lww.com/JNPT/A353.

Phase 4: Select, Tailor, and Implement KT Interventions

Once categorized, KT interventions were selected using the CFIR and targeted the highest priority barriers.[26] Details of the KT interventions were codeveloped by the team.

Phase 5: Monitor Knowledge Use

Clinicians completed a current practice survey approximately 9 months after implementation. Informally, the FIRST-Oslo team reviewed the delivery of the treatment during a weekly group meeting. These discussions included the stepping amounts, new barriers and strategies to overcome them, and program adherence. A clinician audited stepping and provided feedback.

Phase 6: Evaluate Outcomes

We assessed the impact of HIT at the provider, organizational, and patient levels. We conducted surveys to describe clinician attitudes, perceptions, and perceived adherence to program recommendations. Survey and informal interview responses provided information about the organizational impact of HIT. At the patient level, functional outcomes were published.[22]

The research team developed a patient survey to understand the patient's perspective of the HIT program. We modified a generic instrument requesting information about patient experiences in rehabilitation created by the Norwegian Institute of Public Health.[27] Adaptations included removing irrelevant questions, adapting questions to HIT, and adding an open-ended question. Patients were asked to reflect on their experiences with HIT and provide answers to questions using a Likert scale (1= strongly disagree; 2 = somewhat disagree; 3 = somewhat agree; 4 = agree; and 5 = strongly agree). The team discussed the survey and came to a consensus about modifications. The survey was piloted on a small group of patients to obtain feedback. These suggestions were integrated, reviewed by the clinical and research team, and finalized. The questions are listed in Figure 1.

Phase 7: Sustain Use

The clinical teams developed a sustainability plan in collaboration with the KT expert. To select activities that would easily integrate into current institutional processes, the group identified context-specific activities that were standard processes at the Norwegian hospitals. The plan consisted of weekly meetings to ensure that HIT was a high priority, discuss the inclusion of patients in the program, and provide HIT mentoring. The clinicians participated in monthly professional meetings to review HIT articles and provide feedback on clinicians' outcome measurements and treatment characteristics. The clinicians revised the stroke treatment guideline to include HIT at the 2 sites and created a HIT training plan for new employees. Two PTs, including one at each location, led the implementation of the sustainability plan. To assess the impact of this plan, we readministered the surveys 2 years after the completion of implementation.

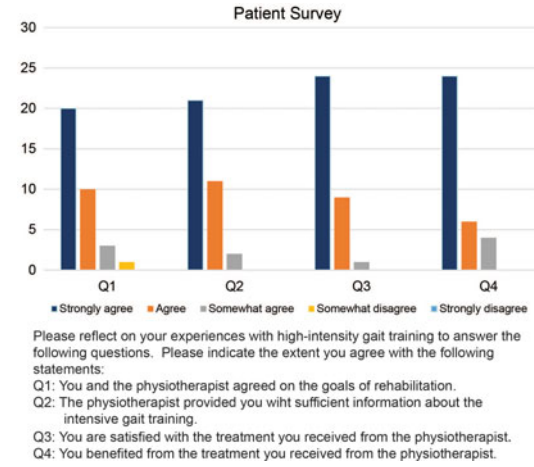

Figure 1. Patient perceptions of high-intensity training.

Statistical Analysis—Surveys

Data collected in the surveys were compared using a Wilcoxon signed-rank test ($\alpha = 0.05$) to determine differences between responses on the surveys from pre- to postimplementation and postimplementation to follow-up (SPSS Statistics version 23, IBM). Informal interview responses were evaluated for themes and described.

Ethics Approval

The Regional Ethics Committee for Medical Research of the South-Eastern Health Region, Norway (2016/873), and the Data Inspectorate at OUH approved the study. Participants provided written informed consent.

RESULTS

While active implementation of measures and HIT occurred over 2 years, the entire project required 5 years for planning and implementation (Figure 2). During the data collection period, 9 clinicians collected data on 110 patients (n = 56 usual care; n = 54 HIT). Since the completion of the implementation phase of the project, staff turnover and growth have occurred. A follow-up survey conducted 2 years after implementation included newly hired clinicians (n = 10). Table 2 describes the clinician demographics from the follow-up survey.

Phase 1: Know-Do Gap Assessment Results

Before implementation, the clinicians reported delivering task-specific walking training and several other interventions regardless of the assistance required to walk. Therapeutic exercise, standing balance activities, and weight shifting or pregait activities in sitting and standing were reported. Perceptions of HIT were generally positive. Clinicians provided neutral responses about making independent clinical decisions and addressing other impairments (eg, balance, transfers) while providing HIT. Clinicians also indicated a

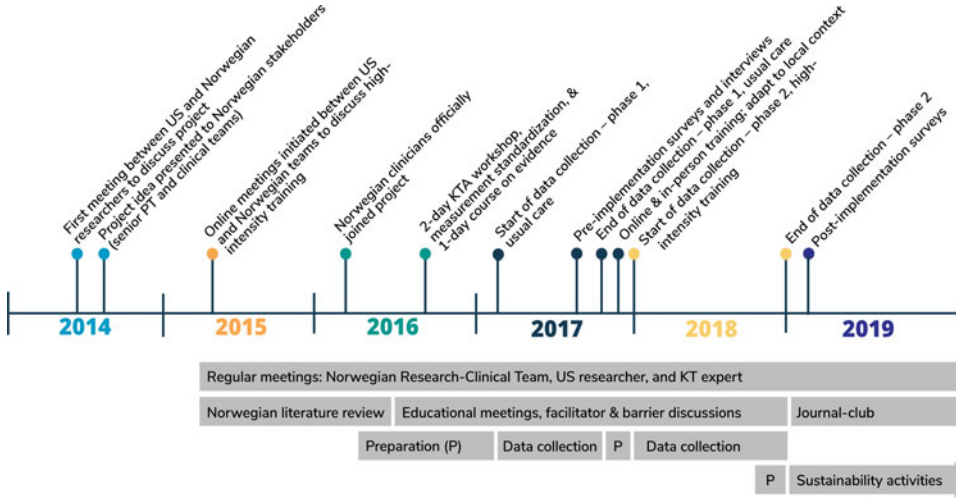

Figure 2. Timeline for implementation. KTA indicates Knowledge-to-Action; PT, physiotherapists.

neutral response when asked whether HIT improves the quality of treatment. The ORIC score before implementation was 44.5 (37.5-49.75; median, range), indicating a high level of readiness. Table 3 describes the initial survey results.

Phase 2: Adaptations to the Practice

Patient Selection for the Program

The project's inclusion criteria were adults (older than 18 years) who sustained a stroke within the previous 2 months, obtained an initial Berg Balance score of more than 3, and were receiving inpatient stroke rehabilitation with goals to improve walking function. Patients who ambulated independently were excluded since they did not have primary goals to improve gait. Other exclusion criteria were the inability to provide consent; use of bracing or instrumentation that limited walking (eg, ventilator); uncontrolled cardiopulmonary, metabolic, infectious, or psychiatric disorders; or previous history of orthopedic or additional neurologic injury that limited walking more than 50 m before the stroke.

Table 2. Characteristics of the Clinicians (n = 10)

Sex
Male: n = 2
Female: n = 8
Age at follow-up in 2020
20-29: n = 3
30-39: n = 5
>40: n = 2
Years of practice in 2020
<5: n = 3
5-10: n = 2
11-15: n = 2
>15: n = 3
Percentage of time on the team that participated in the FIRST project in 2017
40: n = 1
60: n = 1
100: n = 3
Not applicable: n = 5
Percentage of time on the team that participated in the FIRST project in 2020
40: n = 1
100: n = 8
Not applicable: n = 1
Number of patients with stroke seen daily in 2020
<1: n = 1
1-2: n = 2
3-4: n =6
5-6: n = 1

Dose

The team selected a dose using the FITT principle (Frequency, Intensity, Time, Type) and ensured that it was similar to the research and feasible in practice. A frequency of 4 times per week, intensity of 70% to 85% of maximum HR,[28] and 1-hour sessions were recommended. The clinicians adapted the intervention protocol as described by Holleran et al.[11] The intervention's specific walking activities were walking forward on a treadmill, walking on a treadmill doing variable tasks (eg, sideways, backward, over obstacles), variable walking over ground, and walking up and down stairs. The published protocol includes 10 minutes of each type of walking activity. Because of equipment barriers, the FIRST Oslo team decided to tailor walking activities to a specific patient's needs instead of including 10 minutes of each type of walking activity in each session. Patients would perform all 4 types of walking activities during the inpatient stay.

Phase 3: Identified Barriers and Facilitators

We identified several barriers and facilitators to using HIT in clinical practice (Table 4). The most commonly reported barriers were knowledge, beliefs, and adaptability of HIT (eg, what is HIT? Is HIT feasible in practice?). Another

Table 3. Current Practice at FIRST-Oslo Clinical Sites, Before Implementation of High-Intensity Training

	50%-100% Assistance to Ambulate	25%-49% Assistance to Ambulate	<25% Assistance to Ambulate
		2017 Median (IQR)	
Question: Out of 5 patients, please rate the number of patients in which you provide each of the following interventions to improve a patient's ability to walk			
Task-specific gait training	4.5 (4.0-5.0)	5.0 (5.0-5.0)	5.0 (5.0-5.0)
Weight shifting or pregait activities in standing	4.0 (3.75-5.0)	4.0 (3.0-5.0)	3.0 (1.75-4.25)
Sitting balance activities	3.5 (1.0-5.0)	1.5 (1.0-3.0)	1.0 (0.0-2.25)
Standing balance activities	4.0 (2.5-5.0)	4.0 (4.0-5.0)	5.0 (2.75-5.0)
Therapeutic exercises for strengthening	5.0 (3.0-5.0)	5.0 (4.75-5.0)	5.0 (4.75-5.0)
Stretching	1.5 (0.75-2.0)	1.0 (0.0-1.25)	1.0 (0.75-1.0)
Development positions (4-point, tall kneeling, etc)	0.0 (0.0-1.0)	0.0 (0.0-1.0)	0.5 (0.0-1.25)
Bobath treatment	1.0 (0.0-2.0)	0.5 (0.0-1.5)	0.5 (0.0-2.5)
Proprioceptive neuromuscular facilitation	0.5 (0.0-2.0)	0.5 (0.0-2.25)	0.0 (0.0-1.5)
0 = I do not provide this treatment; 1 = 1 in 5 patients; 2 = 2 in 5 patients; 3 = 3 in 5 patients; 4 = 4 in 5 patients; and 5 = 5 in 5 patients			
			2017 Median (IQR)
Question: Please complete the following questions about your perceptions related to current gait training practices for individuals with stroke			
I have sufficient knowledge and skills to use body weight support treadmill training on all of my patients.			4.0 (3.0-4.0)
I have sufficient knowledge and skills to use gait training overground on all of my patients.			4.0 (4.0-5.0)
I have sufficient knowledge and skills to use high-intensity gait training (aims to achieve 70%-85% heart rate maximum and/or rating of perceived exertion of 14-17).			4.0 (3.0-5.0)
If I focus mostly on gait training in my sessions, I feel that I can still adequately address my patients' other impairment areas (such as balance, transfers, etc).			3.0 (3.0-3.25)
The use of the high-intensity gait training program still allows for me to make my own clinical decisions.			3.5 (3.0-4.0)
Coworkers support the use of high-intensity gait training.			4.0 (3.0-4.0)
My supervisor supports the use of high-intensity gait training.			4.5 (3.75-5.0)
Patients support the use of high-intensity gait training.			3.5 (3.0-4.0)
Most of my patients are too impaired to undergo high-intensity gait training.			4.0 (3.0-4.0)
I do not have enough time to provide the recommended dose of high-intensity gait training to my patients.			4.0 (3.0-4.0)
I can provide high-intensity gait training in a safe manner to my patients.			4.0 (3.0-4.0)
The high-intensity gait training program improves the quality of my patient treatment.			3.0 (3.0-4.0)
The use of high-intensity gait training is an integral part of my treatment.			4.0 (3.0-4.0)
My coworkers and I provide gait training to our patients with a similar dose (number of steps, minutes per session, number of sessions per week) to all patients.			4.0 (3.75-4.25)
1 = completely disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = completely agree			

Abbreviation: IQR, interquartile range.

high-priority barrier was available resources (eg, obtaining equipment, securing time to learn about HIT). A culture barrier among the PTs and the interdisciplinary team was identified. Specifically, the PTs reported barriers related to the current practices of delivering many different interventions in a treatment session. They also reported barriers associated with rearranging the schedule and team workflow to incorporate HIT. During usual care, the PTs treated impairments related to gait and upper extremity function. To allocate time for a higher dose of gait training, the interdisciplinary team was involved by delivering upper extremity interventions (occupational therapy), ensuring that the patients were ready for treatment, and placing step monitors daily (nursing). Interdisciplinary barriers were patient scheduling and processes to fit these new activities into treatment. The interdisciplinary team also reported concerns that the patient may be too tired to participate in other therapies and daily activities.

Phase 4: Selected KT Interventions

The KT interventions selected are listed in Table 4, with detailed explanations of the interventions in Supplemental Digital Content Appendix 3, available at: http://links.lww.com/JNPT/A353.

Phase 5: Results From Monitoring

The researchers administered a survey approximately 6 months into the implementation phase. The results indicated that 89% of the clinicians prioritized HIT, improved skills in delivering HIT, and described HIT better to their patients. All clinicians (100%) reported a better understanding of gait-related prognosis and decision-making related to HIT.

Phase 6: Outcomes

Clinician Outcomes

Table 5 describes the results from the pre- and postsurvey. The results identified significantly different responses to questions related to practice and perceptions of high-intensity gait training.

Health System Outcomes

The informal interviews resulted in the identification of a health system–level impact. The participating facilities

Table 4. Barriers and Implementation Strategies According to CFIR Domain and Construct

CFIR Construct	Barrier Description	Implementation strategy/KT Intervention (See Appendix 3 for Detailed Explanations)
CFIR domain: Intervention characteristics		
Adaptability	Clinicians' concerns about feasibility, specifically related to safety, patient capacity to participate, and potential for pain, aphasia, and/or poor understanding of Norwegian language	Promote adaptability Identification of barriers and facilitators Tailor strategies Conduct educational meetings Visit other sites
Cost	Equipment cost	Access new funding
CFIR domain: Inner setting		
Available resources	Personnel costs—training, implementation, operations, etc	Access new funding
	Potential for negative impact on care delivery of patients who were not receiving HIT if resources are limited (eg, PTs sick or on vacation)	Access new funding (attempted but not successful) Local consensus discussions (agreed that these patients would not be prioritized over others)
	Poor accessibility to equipment (from wheelchair to treadmill)	Change physical structure and equipment
	Equipment for safety monitoring (alarm, blood pressure, and heart rate monitors) and orthoses	Access new funding Change physical structure and equipment
	Time management—time for documentation, time for education sessions	Purposely reexamine the implementation
	Enough equipment and possibilities for mutual exchange between sites/floors	Develop resource-sharing agreements
Compatibility	Distribution of patient needs/care among the interdisciplinary team. A primary goal of PT is related to improving upper extremity function. Increasing time spent gait training would result in decreased time focusing on upper extremity function.	Promote adaptability
	Changing long established habits/beliefs/experiences related to workflow, interdisciplinary team, and work-related roles.	Revise professional roles Conduct local consensus discussions Use an implementation adviser Change record system
Culture	Changing long-established habits/beliefs/experiences related to practice beliefs and culture among the PTs	Create a learning collaborative Conduct educational meetings Conduct local consensus discussions
CFIR domain: Characteristics of individuals		
Individual stage of change	Little knowledge of the evidence to support HIT (interdisciplinary team)	Conduct educational meetings Involve executive boards
Knowledge and beliefs about the intervention	Little knowledge of the evidence to support HIT (PTs)	Conduct educational meetings
	Little knowledge of how to provide HIT to patients (PTs)	Build a coalition (RKR, City of Oslo, Oslo University Hospital) Use an implementation adviser Organize clinician implementation team meetings Conduct ongoing training Provide clinical supervision Develop educational materials Distribute educational materials Facilitation Obtain and use patients/consumers and family feedback Remind clinicians
	Little knowledge of the evidence to support HIT (interdisciplinary team)	Conduct educational meetings

Abbreviations: CFIR, Consolidated Framework for Implementation Research; HIT, high-intensity training; PTs, physiotherapists; RKR, Regional Center of Knowledge Translation in Rehabilitation.

represented 2 Norwegian health care systems, the specialist and primary-level services. Norwegian health system goals include ensuring equity in services across the levels and improving coordination and cooperation. The mutual partnership between the 2 levels of care increased the number of patients referred from OUH to OMS during usual care (2017, n = 4) to HIT (2018, n = 25). Co-authorship on the revised local protocol for HIT and guideline for stroke rehabilitation may also increase equity among care levels. The clinician team also observed improved cooperation through joint professional improvement activities such as a journal club, educational courses, and teaching.

Patient Outcomes From the Survey

Thirty-four patients who received HIT also filled out the questionnaire about their experiences with this program. Figure 1 describes the results of the questions. The median score for all questions was 5 (range 1), indicating high satisfaction with HIT. Specifically, 97% of respondents indicated that they somewhat agreed, agreed, or strongly agreed with the

Table 5. Interventions Provide Before and After Implementation of High-Intensity Training

Current Practice—Patients Who Require 50%-100% Assistance to Ambulate			
	2017: Median (IQR)	**2019: Median (IQR)**	***P***
Question: Out of 5 patients, please rate the number of patients in which you provide each of the following interventions to improve a patient's ability to walk.			
Weight shifting or pregait activities in standing	4.0 (3.75-5.0)	1.0 (0.0-1.75)	0.011[a]
Sitting balance activities	3.5 (1.0-5.0)	0.5 (0.0-1.75)	0.041[a]
Standing balance activities	4.0 (2.5-5.0)	0.5 (0.0-1.0)	0.016[a]
Therapeutic exercises for strengthening	5.0 (3.0-5.0)	0.5 (0.0-1.0)	0.017[a]
Current Practice—Patients Who Require 25%-49% Assistance to Ambulate			
	2017: Median (IQR)	**2019: Median (IQR)**	***P***
Question: Out of 5 patients, please rate the number of patients in which you provide each of the following interventions to improve a patient's ability to walk.			
Weight shifting or pregait activities in standing	4.0 (3.0-5.0)	0.0 (0.0-1.0)	0.011[a]
Standing balance activities	4.0 (4.0-5.0)	0.0 (0.0-0.75)	0.015[a]
Therapeutic exercises for strengthening	5.0 (4.75-5.0)	0.0 (0.0-0.75)	0.003[a]
Current Practice—Patients Who Require <25% Assistance to Ambulate			
	2017: Median (IQR)	**2019: Median (IQR)**	***P***
Question: Out of 5 patients, please rate the number of patients in which you provide each of the following interventions to improve a patient's ability to walk.			
Weight shifting or pregait activities in standing	3.0 (1.75-4.25)	0.0 (0.0-0.0)	0.071
Standing balance activities	5.0 (2.75-5.0)	0.0 (0.0-0.75)	0.004[a]
Therapeutic exercises for strengthening	5.0 (4.75-5.0)	0.0 (0.0-0.75)	0.001[a]
Questions About High-Intensity Gait Training			
	2017: Median (IQR)	**2019: Median (IQR)**	***P***
Question: Please complete the following questions about your perceptions related to current gait training practices for individuals with stroke. (1 = Completely disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; and 5 = Completely agree)			
If I focus mostly on gait training in my sessions, I feel I can still adequately address my patients' other impairment areas (such as balance, transfers, etc)	3.0 (3.0-3.25)	4.5 (4.0-5.0)	0.024[a]
The use of the high-intensity gait training program still allows for me to make my own clinical decisions	3.5 (3.0-4.0)	4.5 (4.0-5.0)	0.084
Patients support the use of high-intensity gait training	3.5 (3.0-4.0)	4.0 (4.0-4.75)	0.284
The high-intensity gait training program improves the quality of my patient treatment	3.0 (3.0-4.0)	5.0 (4.25-5.0)	0.014[a]

Abbreviation: IQR, interquartile range.
[a]Statistically significant.

PT about the goals of PT. All (100%) of the respondents somewhat agreed, agreed, or strongly agreed that the PT provided sufficient information about HIT, they were satisfied with the treatment, and they benefited from the treatment. The free text responses described satisfaction with the content and intensity of training. Patients indicated that they were very satisfied with HIT (n = 23), with 10 participants indicating that the intensive training was enjoyable or motivating. One patient stated that the testing was very motivating. Five participants reported that they wanted more HIT in the afternoons and weekends.

Phase 7: Sustainability Results

The follow-up survey identified no significant changes on almost all questions, except for one previously lower scoring area. Clinicians spent significantly less time performing standing balance with patients who required maximum assistance to ambulate in 2020 (median: 0, range: 0.0-0.0) than in 2019 (median: 0.5, range: 0.0-1.0; $P = 0.046$).

DISCUSSION

In this project, the team codeveloped a multicomponent implementation plan guided by the KTA Framework. The project resulted in reported changes in practice, improved perceptions of HIT, and observed changes in stepping activity and intensity.[22] The project appeared to positively impact the health system, as indicated by the improved coordination, cooperation, and equity of service delivery between the 2 health care levels. Patients also reported satisfaction with the treatment. In comparison to usual care, the implementation of HIT resulted in improved patient outcomes.[22] Although many factors may have contributed to the success of this project, we focused the discussion on ones that may have substantially contributed to the project's outcome. The factors include the implementation process (ie, implementation framework and

multicomponent KT interventions that targeted barriers), ease of removing existing usual care practices, and clinician and organizational readiness for change.

Previous studies have attempted to implement evidence into clinical practice with mixed success.[19,29] Use of an implementation framework and multicomponent KT interventions may have facilitated successful implementation in the present study.[29-32] We also used an approach that engaged stakeholders throughout the KT project, also known as integrated KT.[31] Using this approach, we may have obtained greater project relevance and stakeholder buy-in, increasing its success. We codeveloped the KTA plan, identified and reviewed the barriers, and collaboratively selected multicomponent KT interventions. Twenty-six KT interventions were used to implement HIT, and some were repeated interventions. However, other studies demonstrate successful implementation with fewer KT interventions.[30,33] Future research should investigate the most efficient and effective combination of KT interventions to implement HIT.[29,34-36]

In this study, the clinicians reported previously identified barriers to HIT, as well as novel barriers. Previously identified barriers include knowledge, skills, beliefs, consequences (eg, fear of potential harm), professional role identity (eg, not part of routine practice, interferes with other therapies and schedule), and environmental context and resources (eg, equipment).[37] Clinicians also reported novel barriers such as culture, adaptability, and individual stage of change. Established habits and experiences related to workflow, the interdisciplinary team, and culture among the PTs were described as initial challenges to the use of HIT. Some habits were related to scheduling and workflow, while others included the treatment interventions used. Clinicians cited concerns about the feasibility of using HIT, including whether the intervention was feasible in the clinic. Future research should determine the most impactful barriers to prioritize during implementation efforts.

De-implementation, or removal of existing practices and lower-value interventions, is a challenge for translating evidence-based practices into the clinic.[38] Factors affecting de-implementation include the characteristics of the interventions that need to be removed from practice. One characteristic to note is the intervention's complexity, with less complex interventions being easier to de-implement.[39] In this project, the clinicians were already using task-specific gait training practices and other interventions (eg, pregait, weight shifting, and standing balance). Treatments did not consist of traditional therapies such as Bobath treatment (ie, neurodevelopmental treatment) or Proprioceptive Neuromuscular Facilitation, which have been prevalent in neurologic physical therapy for decades. While research demonstrates that these approaches are inferior to task-specific methods, they may be challenging to remove from clinical practice.[40-43] In this project, implementation did not require adopting a new treatment philosophy. Instead, the clinicians included more task-specific practice and fewer other interventions. The content of usual care may have facilitated a more rapid and successful adoption of HIT. Research examining the implementation of HIT in facilities using traditional approaches should study readiness for change, barriers to implementation, and methods to successfully implement evidence-based practices.

The clinicians and organizational readiness to change, stakeholder engagement, and clinician leadership support may positively impact implementation and de-implementation efforts.[39,44] Before deciding to participate in this implementation project, the clinicians and leaders met regularly to understand HIT research and its application to practice. The research team provided HIT education and publications. During this process, the clinicians reached a consensus that HIT should be implemented and committed to making this change happen. They also believed that the organization could make the change, as exemplified by the high ORIC score. When the implementation phase started, the clinicians set a date to stop the other interventions and replace them with HIT. The group also held each other accountable through discussions, audits, and feedback. While these factors may have facilitated successful adoption, we are uncertain of their relative contribution to the changed practice.

Study Limitations

Limitations of this study suggest that future research is warranted. Since this project did not include a control group, we cannot make definitive conclusions about the KT strategies used. We also implemented this project in only 2 levels of care in Norway. Future research should determine the effectiveness of these implementation strategies in other contexts, including facilities with different therapeutic approaches used in usual care and different clinical cultures. The implementation strategy included 26 KT interventions, a KT framework, and integrated KT. Other factors, such as the content of usual care, organizational characteristics, provider characteristics, and patient characteristics, may have also contributed to the study's positive outcome. We are unsure of each of these components' relative contribution to the implementation project's success, which should be studied further.

CONCLUSIONS

Using the KTA cycle, we developed a multicomponent implementation plan to translate HIT into subacute stroke rehabilitation. The project included integrated KT, multicomponent KT interventions, and an iterative approach of reassessing barriers and implementing KT interventions. As a result, we observed positive clinician, patient, and health system outcomes. Other factors that may have contributed to the project's success are the ease of de-implementation and readiness for change. It may be beneficial for organizations and clinicians to consider a multicomponent approach and these additional factors when implementing HIT.

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