# A protocol to assess the effect of high-intensity interval/circuit training using functional and primitive reflex exercises on cognitive function and quality of life in the substance use disorder recovery

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**Abstract**

This protocol aims to examine if structured physical activity reduces the recovery time of cognitive functioning during the early phase of substance use disorder treatment. Addiction or substance dependence is associated with neurobiological changes and cognitive impairment, which may affect the quality of life and ability to benefit from therapy up to a year after clinical detox. A physical exercise is a therapeutic approach which may lead to increased quality of life as well as relief of symptoms associated with substance abuse, such as psychosis, depression, and anxiety, due to its biological, psychological and social effects. There is a dearth of research on physical activity or exercise in clinical substance use disorders patients. This clinical study protocol examines cognitive recovery after substance abuse using physical exercise as a treatment intervention. This study is using quasi-experimental longitudinal clinical trial with pretest and multiple posttests, on two-time sequential groups that are naturally randomized before group entry. Patients are continuously recruited into the study groups. Starting with a controlled group and finalizing it and sequentially followed with a new group with intervention. Sixty patients are divided into control and intervention group. Patients are enrolled two weeks after the start of detoxification, at which time all subjects are inpatients at the Salvation Army treatment Center Stavanger in the Norwegian specialized healthcare system. Cognition is evaluated using a comprehensive battery of cognitive tests, including several tests of executive functioning. Physical fitness is tested with Rockport 1-Mile Walk Test, 30 Second Chair Stand Test. Also, the 1-minute Burpee test and the presence of primitive reflexes tested at baseline within the first two weeks of admittance and after four weeks. The intervention consists of 30 minutes' workout, at 70-90% of max heart rate (134-170 bpm), recorded by a Polar heart rate monitor. The adjunct treatment is four times a week for four weeks of high-intensity training using circuit training (HICT), as well as HIIT functional movement and primitive reflex training. After the intervention protocol, an improvement is anticipated in both groups, with the exercise intervention group having the most considerable increase in

return towards normalizing cognitive functioning due to having combined functional full body movements with primitive reflex training in an intensity interval training setting.

**Keywords**: Physical activity, HIIT, HICT, SUD, Brain health, Neurocognition.

## Introduction

Substance use disorders (SUD) are among the most prevalent chronic and severe diseases in the world in terms of mortality and disability (1), and it is associated with considerable social, economic, and individual health consequences (2–6). The combination of impaired physical and mental health among the SUD populations is associated with a life expectancy of 20-30 years below the general population (7,8). Individuals with SUD have a high tendency for comorbidity. Compared with the general population, the SUD group has more frequent contact with the health care system (9–11) due to a variety of illnesses like cancer, diabetes, suicide, cardiovascular diseases and different kinds of physical trauma (7,8,12). Depression, anxiety, Attention Deficit Hyperactivity Disorder, personality disorder, and psychosis are among the most common comorbidities (13–18). Individuals with SUD also have a high prevalence of cognitive impairment. That can contribute to drop-out of treatment and low quality of life (19–26). A recent study (21) also highlighted the importance of adequate recovery time for cognitive functions. Although pharmacological and psychological interventions are well established in the treatment and the research field, relapse rates are commonly high. The success rates in sud treatment provide a good argument for an adjunct treatment focus in the SUD population, with an intervention targeting both physical and mental health.

Physical activity may be an excellent adjunct treatment to already exciting treatment regimens by improving the patient's function and reducing symptoms. Exercise is a subcategory of physical activity that is planned, structured, repetitive, and designed to improve or maintain physical fitness, physical performance, or health (27). The general effects of physical activity are most significant when going from an inactive lifestyle to a more physically active lifestyle (28,29). Exercise-based interventions are well established in the mental health service and the research field. Increased physical fitness, positive effect on depression and anxiety symptoms and less negative symptoms for patients with schizophrenia are some of the results from mental health research (30,31). Exercise interventions have also been observed to have positive effects on cognitive functions for severe mental illnesses (32), perhaps partially through the impact on the brain. Such research gives a persuasive argument for the exploration of exercise-based interventions on chronic or severe SUD populations.

However, there are only limited studies exploring the impact of physical activity or exercise in patients with SUD (33,34). As part of this study, we conducted a literature search in Embase, Medline, SPORDiscus, PsycINFO and CINAHL in September 17.2017, using the search terms: “High-Intensity Training (HIIT)”; “high-intensity training circuit training (HICT “; “cognitive function” and “SUD.” The results of our search gave eleven articles(31,33,35–43) of relevance to this study. Research with the use of physical activity for SUD populations is related to outpatients or inpatients in recovery after withdrawal(33). Physical activity or exercise for SUD populations can improve physical fitness,

cardiovascular health, sleep quality, and reduce withdrawal symptoms of substance use, anxiety, and depression symptoms (33,34,44–46). It has also been observed that engaging in a physical activity program during treatment can contribute to reduced drop-out rates, hence increasing the success rate of therapy (42). Although these studies present promising results, many studies have methodological limitations, e.g., they are pilot studies and lack control groups. Due to the positive impact on mental health, we believe it is of great importance to explore exercise interventions in the clinical treatment and recovery for SUD populations. Preexisting data and approaches in the field of mental health and SUD show great promise e.g. high intensity interval training (HIIT) principles have been found to increase health benefits (39,47,48). However, there is lacking data on dose, intensity and the most beneficial type of exercise preformed.

1. This study protocol is designed to investigate HIIT and HICT combined with functional exercises and primitive reflex training, about the recovery of quality of life and cognitive functioning in patients with SUD. More specifically, the protocol aims to: Examine if structured physical activity reduces the recovery time of cognitive functioning when compared to a control group.
2. Examine if different intensities of physical activity, e.g. HIIT/HICT versus other types of physical activity, e.g. Hiking) is associated with different trajectories of cognitive recovery in the sub-acute phase of SUD treatment.
3. Examine if the presence of primitive reflexes is suited as a proxy-indicator of cognitive function.

This research-protocol has several possible applications. First, it enables new studies to reproduce the exercise protocol and increase the knowledge base when it comes to substance use disorder and its effect of exercise using a descriptive exercise regime, which is one of the more significant problems in exercise literature, e.g. from the inadequate description of the exercise, dose, intensity, and how it is implemented in the studies, which gives reduced reproducibility. This protocol and training regime would work as a base to start comparing other work out routines, types of exercises, and duration. Since this exercise regime is compared against a control group and so be validated do have a positive or negative effect on the substance use disorder population during a sub-acute clinical setting.

Secondly; Since it is so few studies on exercise and substance abuse would a protocol make it easier to reproduce and increase the number of studies identical exercise regimes by using this protocol as inspiration or reproduce it. That would contribute to compare different studies up against each other like a systematic review and meta-analysis.

Thirdly, the protocol has been designed in this way to be able to have a control and intervention group is different from the physical training aspect. The patient group would be able to accept without high dropouts. Previous studies done by KORFOR have been terminated when the randomization was between control and intervention. The subject population did not want to participate any more when they self could not decide their activity group, and this was regardless of what the patient was allocated to. This problem might be some part of the reason why there are so few studies on this patient group when it comes to physical exercise on quality of life and cognitive function.

Fourthly, if the protocol is effective in increasing the cognitive and quality of life stats for the participants of the study, the training regime is easy to implement in a clinical setting without any high demands of equipment and extensive schooling of staff, and it would be low cost.

**Materials and Equipment:**

*Design:*

The study is designed as a quasi-experimental longitudinal clinical trial with pretest and multiple posttests, on two-time sequential groups that are naturally randomized before group entry. This trail is conducted in a running clinical setting as part of the daily treatment interventions conducted at the Salvation Army treatment center Stavanger (FAB). Testing the efficacy of HIIT in the recovery of cognition in patients with SUD. After completion of the trail, patients followed prospectively for one year.

*Control group:*

An active control group consisting of SUD inpatients recruited from the same treatment facility was included. The control group received treatment as usual (TAU) for substance use disorder patients. Focusing on activities of daily living (ADL) which consist of personal hygiene, e.g. washing oneself and brushing teeth. Sleep hygiene is focused on by regular rest times and wake up time to help normalizing sleep pattern. Learning or relearning preparing, making, and cooking food. Eating in a social setting at fixed times. House cleaning and work assignments relevant to make the ward work smoothly. Structured socializing, and group sessions, two times a day. Structured physical activity in the form of one daily hike with a duration of 30-120 min, and a long hike for a few hours once a week.

*Intervention group:*

Receive the exercise protocol four times per week, of 30-minute duration each session. This group have identical TAU as the other group

*Randomization:* There is no randomization into the two groups as an RCT have. Though there is natural randomization of participants into each group due to having an external system consisting of three separated units allocating patient with different needs independently off each other on to short waiting list due to the population dropout rate, the patient on the list is randomized naturally at this point, also due to SUD patients dropping out of the waiting list for entry to treatment.

*Ethical statement*

The research project was approved by the Regional Ethics Committee for Medical Research Ethics, Western Norway (2011/1877). Written consent

*Equipment:*

Polar M200 watch. Polar M360 watch, weight scale, Stop Watch, Chair, Running track. (Stavanger Stadium). Exercise sling, two gym mats, Computer for neurocognitive test and Tabata timer.

**Stepwise Procedures**

1. Recruitment and eligibility: Patient is recruited from Helse Vest catchment area via sub-acute treatment facility FAB. Eligibility: SUD diagnosis, emitted as an inpatient to FAB. 18 year of age or older. Pass the physical evaluation for the institution to perform intensive training. No medical history or illness that is contraindicated to participate in physical activity. Light to moderate psychiatric diagnoses is included. Excluded from the study if medical history, e.g., Physical disability, disease or injury that could interfere with or be worsened by physical activity (eg, paralysis, inability to sit, stand and/or walk, severe pain, obstructive disease, glaucoma) or a severe cognitive deficit (eg, dementia). A severe cognitive deficiency will be assessed based on two questions: 'Do you have troubles with your memory that affects your daily life?' and 'Do you have a diagnosis for dementia?'. Younger then 18years.
2. Baseline testing: both physical and Neurophysiological test are conducted within two weeks of admittance to the Salvation Army Treatment Center.
3. Randomization is not done by the researcher, though there is natural randomization due to the system, and it is continuous throughout the study.
4. The intervention: The Physical exercise protocol is conducted for four weeks.
5. Final tests of physical function are conducted the week after the exercise protocol is completed. Prospective follow up: the cognitive test is repeated 3, 6, 9, and 12 months after the baseline test.

Testing procedure:

Rockport 1-Mile Walk Test. Is going to be performed at Stavanger stadium outdoors. The patient must walk for 4x400 meters and are being timed. Pulse is recorded when the test person walks over the finish line (49).

30 Second Chair Stand Test: is conducted by having the patient perform as many sit-stand-sit cycles possible for them during a 30-second test (50,51). The result is the number of cycles done. This test will be conducted at the Salvation Army Treatment Center.

1-minute Burpee test: this is a functional test and outcome measure for participants and s study outcome. The Burpee is a total body exercise used in strength training, high-intensity training, and aerobic exercise. It is designed to develop strength, agility, coordination, and aerobic performance.

The test starts with the subject in a standing position with their feet shoulder-width apart. They then drop into a squat position with their feet underneath them and their hands on the ground. Quickly they then extend their feet in one motion to assume the front plank position with legs completely extended and back straight. Return to the squat position then jump straight into the air as high as possible. Repeat. This entire exercise is intended to be performed in a fluid, rapid movement (52).

Physical exercise/intervention protocol:

The study uses high-intensity interval circuit training based on functional exercise movements in combination with primitive reflex training exercises conducted in a four-week program, examining the recovery of cognitive function after chronic SUD. In the present literature, high-intensity training comes out as a high yield training form and among the different types of exercise (39). Best evidence recommend a minimum of 3 sessions a week with a training duration of 30 - 60 minutes per session (48,53). The length of the training programs varies from 4 to 9 weeks in the literature. Due to our patient group being on short term stays within the facility, the training, and control period is chosen to be a four-week program. The physical exercise protocol consists of 30-minute sessions with an active warm-up included. Four sessions are conducted each week with a target heart rate of 70-90% of the patient's maximum heart rate (220 beats per minute minus the patient's age). Each training session is identical and divided into a warm-up at 60-70% of max heart rate (114-133bpm), work is done at 70-90% of max heart rate (134-170 bpm), with a cut off at 90% (171 bpm), followed by an active cool down. Polar heart rate zones are used to control the exercise intensity throughout the training session. In this study, we plan to use body weight functional exercise due to low cost and need of equipment to implement. The session consists of nine exercises: Air squats, cat/camel, reverse rowing with a sling, starfish, burpee, sit-ups with frog legs, crawl (ATNR reflex exercise), jumping jacks and push-ups. The training is done in 9 stations with 45 seconds of work and 15 seconds rest to change stations. Three circuits are completed with 25 seconds rest between each circuit. The active cooldown consists of walking for five minutes. The nine functional exercises are assembled off: Air squats, Cat/Camel, Inverted rowing with a sling, Stare fish, Burpee, Sit-ups with frog legs, Crawl (atnr) Jumping jacks and Push up. Appendix A contains further description and information about the exercises in the protocol.

Neurophysiological test:

The cognitive tests are the same as those selected for the Stayer study as a part of a cognitive test battery to follow the mental health of the participants in that longitudinal cohort study. The present study is an intervention study nested within the Stayer study. All the neurophysiological test is conducted by the same research assistant whose specialty is performing neurophysiological testing:

The Symptom Checklist-90-Revised (SCL-90-R) is a 90-item self-report symptom inventory developed by Leonard R. Derogatis in the mid-1970s to measure psychological symptoms and psychological distress. It is designed to be appropriate for use with individuals from the community, as well as individuals with either medical or psychiatric conditions. The SCL-90-R assesses psychological distress in terms of nine primary symptom dimensions and three summary scores termed global scores. The principal symptom dimensions are labeled Somatization (SOM), Obsessive-Compulsive (OBS), Interpersonal Sensitivity (INT), Depression (DEP), Anxiety (ANX), Hostility (HOS), Phobic Anxiety (PHOB), Paranoid Ideation (PAR), and Psychoticism (PSY). The global measures are referred to as the Global Severity Index (GSI), the Positive Symptom Distress Index (PSDI), and the Positive Symptom Total (PST) (54).

Satisfactions with life Scale: (SWLS) Among the various components of subjective well-being, the SWLS is narrowly focused on assessing global life satisfaction and does not tap related constructs such as positive affect or loneliness. The SWLS is shown to have favorable psychometric properties, including high internal consistency and high temporal reliability. Scores on the SWLS correlate moderately to highly with other measures of subjective well-being and correlate predictably with specific personality characteristics(55,56).

The Montreal Cognitive Assessment (MoCA)(57) took approximately 10 minutes to administer and was designed to detect mild cognitive impairment in elders scoring in the normal range on the MMSE. Thirty items assessing multiple cognitive domains are contained in the MoCA: short-term memory (5 points); visuospatial abilities via clock drawing (3 points), and a cube copy task (1 point); executive functioning via an adaptation of Trail Making Test Part B (1 point), phonemic fluency (1 point), and verbal abstraction (2 points); attention, concentration, and working memory via target detection (1 point), serial subtraction (3 points), digits forward (1 point), and digits backward (1 point); language via confrontation naming with low-familiarity animals (3 points), and repetition of complex sentences (2 points); and orientation to time and place (6 points) (57). The MoCA is scored by obtaining an item total and the authors recommend a clinical cutoff score of 26(57).

Behavior Rate Inventory of Execution Function-Adult Version (The BRIEF-A) The Self-Report Form is designed to be completed by adults 18-90 years of age, including adults with a wide variety of developmental, systemic, neurological, and psychiatric disorders such as attention disorders, learning disabilities, autism spectrum disorders, traumatic brain injury, multiple sclerosis, depression, mild cognitive impairment, dementia and schizophrenia. The BRIEF-A is composed of 75 items within nine nonoverlapping theoretically and empirically derived clinical scales that measure various aspects of executive functioning(58,59).

The Stroop Color and Word Test (SCWT) is a neuropsychological test extensively used to assess the ability to inhibit cognitive interference that occurs when the processing of a specific stimulus feature impedes the simultaneous processing of a second stimulus attribute, well-known as the Stroop Effect. The aim of the present work is to verify the theoretical adequacy of the various scoring methods used to measure the Stroop effect(60,61).

The Trail Making Test is a neuropsychological test of visual attention and task switching. It consists of two parts in which the subject is instructed to connect a set of 25 dots as quickly as possible while still maintaining accuracy(62). The test can provide information about visual

search speed, scanning, speed of processing, mental flexibility, as well as executive functioning(63–66).

The ASRS includes 18 questions about the frequency of recent DSM-IV Criterion A symptoms of adult ADHD. The ASRS screener consists of six out of these 18 questions that were selected based on stepwise logistic regression to optimise concordance with the clinical classification. ASRS responses were compared to blind clinical ratings of DSM-IV adult ADHD in a sample of 154 respondents who previously participated in the US National Comorbidity Survey Replication (NCS-R), oversampling those who reported childhood ADHD and adult persistence (67).

AUDIT consists of a 10-item Core questionnaire and an 8-item Clinical procedure. AUDIT was designed to identify hazardous drinkers (whose drinking increases their risk of alcohol-related problems, though alcohol-associated harm has not yet occurred); harmful drinkers (who have had recent physical or mental damage from their drinking, but who are not alcohol-dependent); and people with alcohol dependence (68).

Drug Use Disorders Identification Test (DUDIT), an 11-item self-report questionnaire developed to screen individuals for drug problem (58).

The quality register is a national semi-structured interview for the Norwegian health care system. With the aim, to be used as a tool for patient feedback, mapping of the patient health, quality of life, employment, housing and education.

Measurement of primitive reflexes:

The primitive reflexes chosen for this study are among the primitive reflexes or frontal release sign's that occur in literature for Attention deficit hyperactive disorder (ADHD) and developmental coordination disorder (DCD). Frontal release sing and primitive reflexes are also a sign of mental function (69–71).

The asymmetrical tonic neck reflex (ATNR) was assessed using the Schilder Test (72). The test for ATNR has low validity, and other similar analysis had poorer validity (73). This version of the test was chosen because it's a non-invasive and low-cost test. The test position was demonstrated and explained to each participant as follows: «Stand upright with feet together, and arms held straight out front at shoulder level, with wrists relaxed. The patient was asked to close their eyes and keep their hands in the same position, only moving the head 70 to 80 degrees to the side, or when the chin touches the shoulder. The practitioner stands behind the patient and turns the patient's head to the left, holding the position for five seconds and then returns it to the neutral starting position. Then the same was performed on the right side. ». The procedure is performed twice. Positive signs of the ATNR test are; the movement of the extended arms in the same direction as the head turns, dropping of the arms or swaying and loss of balance (74). The occurrence of asymmetrical tonic neck reflex is up to 40% in the normal population (75). Validity and reliability (73).

Moro reflex or Erect test for Vestibular-activated Moro (76,77): was tested with the subject standing with feet together, arms and body at a 45-degree angle with hands flexed at the wrists. Test procedure: The examiner stands behind the subject and instructs the patient to bend their head back as if looking at the ceiling, with closed eyes. Once the subject has stabilized in this position, the practitioner instructs the patient to stand still and fall backwards when an audio cue is given. The practitioner must be prepared to catch the full weight of the

subject. Positive signs are: abductions of arms, falling back, inhaling, or crying when losing the center of gravity. Note that any arm movements or loss of balance as a result of putting the head in extension indicate a positive test (78,79).

Galant reflex: was tested with the patient prone Scratching the skin of the patients back from the shoulder downwards, 2-3 cm lateral to the spinous processes. A positive test is incurvation of the trunk, with the concavity on the stimulated side four months (80). The occurrence of this reflex among the average population after 12 months of life, was not verified. This is an often just test in the literature of the field it is just in. This protocol was not able to find literature confirming the validity and specificity of the Galant reflex test used from other studies done previously.

The Palmar Grasp Reflex: was tested using the Palmar grasp test protocol. The examiner places the index finger in the palm of a baby, resulting in flexion of fingers making a fist. This reflex is normal in infants up to 6 months old. For older subjects, the usual reaction is no response. (81) (82) The occurrence of this reflex among the healthy population is 0-1% (83) with high validity and reliability (73)

Glabellar Reflex, (Mayerson sign): The test is performed by the examiner repeatedly tapping the glabellar prominence lightly with a finger. A typical subject will blink in response to the first two or three taps only. Subsequently, the subject adapts to the stimuli, and the blink response ceases. A positive response occurs if the blink response persists with subsequent stimuli. A positive response can indicate Parkinson's syndrome (84). The reported frequency for the glabellar sign is 18% for men and 16% for women aged 25-82 (71,85). This test has a sensitivity of 83.3% and specificity of 47.5% for Parkinson’s disease, which is a neurological disease affecting the motor system (73,84).

Mouth/Palmomental reflex: This reflex is observed in normal newborn babies, who automatically turn the face toward the stimulus and make sucking (rooting) motions with the mouth when the cheek or lip is touched. The rooting reflex helps to ensure successful breastfeeding (86) (77). This reflex was considered positive if any noticeable contraction of the mentalis muscle could be elicited by a vigorous stroke of a thumbnail along with the ipsilateral thenar eminence of the face. The prevalence of Mouth/Palmomental reflex is 6-27% in a healthy population (81) with high reliability (87,88), and test sensitivity of 33% and test specificity of 90% for Parkinson’s disease(84).

# Anticipated Results

In this study, we expect that both groups will show progress in both physical and mental health after a period of substance abuse. We believe that data generated in this project will

mostly be on interval or ratio level (whether the rating of perceived exertion is ordinal, or interval data will not be discussed here). To express group results, the mean will serve as a measure of the central tendency, with the standard deviation expressing the spread of results within the group. If useful, the standard error of the mean (SEM) will be used to express the accuracy of the mean value. If results are highly skewed (skewness > 1.5), a log transformation and geometric mean will be used together with a 95% confidence interval to express central and spread tendencies. To compare results over time from pretest, posttest, and between-group differences. ANOVA/t-test of repeated measures will be performed with a Sidak/Holmes post hoc test. Group comparisons will be made with an ANOVA/t-test for independent groups. If the test of normality should fail (Kolmogorov-Smirnov with Lillienfors correction), the corresponding non-parametric tests will be used, i.e. the Wilcoxon-Mann-Whitney Rank Sum Test for independent t-tests and ANOVA on rank for repeated measures (Tukey post hoc). The level for statistical significance will be set at the traditional p-value of $p \leq 0.05$. Effect sizes will be calculated according to Cohen (1988) with the help of an online effect size calculator (the CEM effect size calculator, Centre for Evaluation and Monitoring, Durham University, Durham, United Kingdom: http://www.cemcentre.org/ evidence-based-education/effect-size-calculator). An effect size of $\geq 0.5$ will be considered clinically relevant (two-sided). If there is a need for building indexes of different types of scores, Z-scores will be used. The statistical power of 0.8 can be reached with at least ten subjects in two groups, based on previously published data on fitness development and depression score. Target recruitment is nonetheless set higher than this with n = 30 in each group.

The adverse influence of the Study:

The two test groups are not run at the same time. This will create a time discrepancy and is not ideal in terms of bias. However, this is done based on previous failures of recruitment and having participants in previous studies drop out at a high rate where similar studies have been terminated due to low participant numbers and the inability to follow through with the investigation. The length of the study is not fixed. Due to funding and support, this study can continue until the quota for participants is met.

There is only one practitioner testing the primitive reflexes, and the testing will not be filmed to prevent tester bias. The literature on primitive reflexes contains a mix of old and recent data. Primitive reflex tests performed in previous studies are not identical in all studies in the literature. The tests conducted and picked in this study were chosen due to their ease of use in a clinical setting, with a minimal requirement for equipment and replicability in future studies.

The study follows the best possible clinical reality, which doesn't split the different SUD groups during the treatment, and the project protocol does not divide the different groups of SUD after classification. This might bring some problems with the results from baseline due to various issues with the abuse of different drugs and given side effects might affect the test results differently. We will account for this by matching the type of substance abuse and allocated diagnosis's in the data collected against the groups.

The patient population will be recruited straight out of a detox clinic, which will most likely influence the test results. Since it is done so quickly after controlled medical supervised detoxing, the patients' weaknesses will be exposed more clearly and maybe a more accurate current picture of mental status for a substance abuse patient straight out of drug detox clinic.

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Author Contributions

Authors conceived the study. Ø. Andreassen wrote the manuscript and contributed with scientific-clinical expertise. E. Furulund and Aleksander H. Erga also contributed to writing this manuscript. S. Nesvåg contributed to project oversight and resource control. A. Njå contributed to designing the protocol.

Conflict of Interest Statement

The authors declare no conflicts of interest. All research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. The patient in the study was compensation for lost income to the participants that could be perceived as payment to get specific responses

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All sensitive data (digital and non-digital) generated is confidential and will be treated according to the standards set by the Norwegian Data Inspectorate (Datatilsynet) and in compliance with the Health Research Act and the Personal Data Act. Data generated in this project will mostly be on interval or ratio level (whether the rating of perceived exertion is ordinal, or interval data will not be discussed here.

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