DISCLAIMER

The views expressed in this document are not necessarily those of the Government of Canada, or the Department of National Defense, or the Canadian Armed Forces, or the Canadian Forces Morale & Welfare Services, or Personnel Support Programs. The author does not have any potential conflicts of interest or bias to declare. This research did not receive funding. Personal funding was received in the form of tuition assistance generously provided by Canadian Forces Morale & Welfare Services.

The effectiveness of Return to Duty Intervention: Evaluating an interdisciplinary approach to supporting Canadian Armed Forces members who have physical and non-physical disorders

by

Sébastien Périgny-Lajoie

A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Science

in

Rehabilitation Science

Faculty of Rehabilitation Medicine
University of Alberta

ABSTRACT

The rate of musculoskeletal and mental health disorders is high in the Canadian Armed Forces, and can preclude service members from being employable and deployable. The aim of this thesis was to analyze the effectiveness of the Return to Duty intervention at decreasing morbidity and assisting service members to be retained by the Canadian Armed Forces. Using a multiple baseline single subject design, the physical and mental function of the participants was measured repetitively pre, during and post-intervention. In total, 23 participants were enrolled in the Return to Duty intervention, where they received physical training with health and work literacy once a week for 10 weeks in a group. Analysis was performed with descriptive statistics and visual analysis using Minimally Important Difference for significance. Six months post-intervention, return to duty outcome was measured. The confirmed return to duty rate was 39.1% at 6 months post-intervention, with an additional 34.8% expecting to return to duty. Amongst the measures, the 4 Squares Step Test, Work Ability Index and SF-36v2™ physical component improved in respectively 70.6%, 47.1% and 66.7% of the confirmed and expected favorable outcome group (73.9% of the sample). Deterioration in function was found mostly in the unfavorable group, notably in mental health measures; possibly indicating that mental health could be a mediator of return to duty. Overall, most of the repeated measures did not change meaningfully, potentially suggesting an ecological model of return to work. The study found a superior confirmed return to duty rate compared to nationally in the Canadian Armed Forces, and a superior expected favorable return to duty rate, compared to any bases/wings. The return to duty processes in the Canadian Armed Forces have not been previously published therefore, this thesis provides a novel contribution to the scientific literature. Furthermore, this thesis helps to understand factors that might increase the retention of the service members in the Canadian Armed Forces. Finally, this work makes recommendations for future studies in return to duty in armed forces.

PREFACE

The idea of staff from different disciplines working together on a work rehabilitation program at the 3rd Canadian Division Support Base Edmonton belongs to Major Daniel Crumback from the 1 Field Ambulance. This document is the extensive development of this initial idea. This thesis is an original work by Sébastien Périgny-Lajoie. Section 16 was written for journal publication intent, but no part of this thesis has been published at the time of submission.

“…honor, sacrifice and solidarity, which are our military's credo and our country's ideals.”

Mr. Rex Murphy, Canadian Broadcasting Corporation *The National*

ACKNOWLEDGEMENTS

Thank you foremost to my family and friends for their support. A special mention is given to Personnel Support Services for their support in this project. We are grateful to the research participants; to those service members who invested sweat, tears, laughter and blood to improve knowledge and rehabilitation for all of their peers. This project was dependent on a large team of collaborators and friends working in-kind toward a common goal of improving the return to duty of the service members of the Canadian Armed Forces. Apologizing in advance for any omissions; we are extending our immense gratitude to:

Ali Connell
Allison Gaudet
Dr. Alice Mohr
Angela McQuire
Auty Brooks
Caroline Cormier
Charity Simmons
Chelsea Jones
Courtney Sloan
Captain Daniel Garand
Dr. Curtis Hlushak
Danielle Allard
Denise Hasting
Derek Coe
Dr. Douglas Gross
Dr. Éric Parent
Frédéric Rancourt
Master Corporal Frieda VanPutten
Dr. Geoffrey Bostick
Heather Gareau-Miller
Dr. Jacqueline Hebert
Jennifer Day
Josey Yearley
Katerine Riddle
Kevin Kiely
Captain Leigh Pinard
Dr. Lisa Antoniolli
Lucas Grasby
Lynn Crawford
Marcel Roy
Margaret Ovens
Mayank Rehani
Captain Mundeep Chana
Dr. Nicolas Thibault
Nicole Emerson
Rebecca Weller
Richard Stauffer
Robert Schwartz
Colonel Robert Stiegelmar
Captain Scott MacLean
Steve Stawiarski
Tammy Buchanan
Dr. Terrence McDonald
Tovah Fenske

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS/ABREVIATIONS/SYMBOLS

A: Air
CAF: Canadian Armed Forces
CV: Colour Vision
DMCA: Directorate of Military Career Administration
DMedPol: Directorate of Medical Policy
DMilC: Directorate of Military Careers
FORCE: Fitness for Operational Requirement of CAF Employment
G: Geographic
H: Hearing
M: Mean
MBD: Multiple Baseline Design MEL: Medical Employment Limitations
MHD: Mental Health Disorders
MID: Minimally Important Difference
Min: Minutes
MSD: Musculoskeletal Disorders
O: Occupational
OQ® 45.2: Outcome Questionnaire® 45.2
PHQ-9: Patient Health Questionnaire-9 items
PSFS: Patient-Specific Functional Scale
Pts: Points
PTSD: Post-Traumatic Stress Disorder
RtD: Return to Duty intervention
S: seconds
SD: Standard Deviation
SF-36v2™: Short Form-36 questions version 2™
SM: Service Members
SSD: Single Subject Design
U of S: Universality of Service
U.S.: United States of America
V: Vision
WAI: Work Ability Index
4SST: 4 Squares Step Test
5TSST: 5 Times Sit to Stand Test
$: Dollars
£: Sterling pounds
≥: Equal or greater than
+: Improvement
0: No change/ambiguity
-: Deterioration
Δ-index: Change-index effect size

1. AUSTERE DEMANDS OF THE MILITARY LIFE

The challenges of military life and duty are immense with members working in rigorous and demanding occupations throughout the Canadian Armed Forces (CAF). The hardship of soldiering requires extensive physical demands for long duration in time, such as marching during deployments with heavy loads, inducing significant stress on the spine and lower extremity.[1, 2] In addition to requiring a high level of physical fitness,[3, 4] Service Members (SM) must be able to multitask by performing weapon handling, radio communication and negotiation of obstacles.[5] Unsurprisingly physical and mental fatigue, high stress level, inadequate/disrupted sleep and hydration/nutritional challenges are commonly experienced in armed forces.[5-7] These austere demands may lead to the inability to continue duty. Everyday in the United States of America (U.S.) Army, more than 43,000 soldiers (the equivalent of 12 combat brigades) are in a non-deployable status; annually this represents 10 million limited/loss duty days of which, 80% were preventable.[8] This can lead to an immense lack of productivity and training in the armed forces. For example, in a prospective cohort in the U.S. military, 31 out of 41 combat diver qualification course participants sustained burnout.[9] In the Dutch Ministry of Defense, schools and training units can face up to 68% dropout rate.[10] Globally, austere demands of military life commonly lead to a high level of Musculoskeletal Disorders (MSD).

2. THE MAGNITUDE OF MUSCULOSKELETAL DISORDERS

"A single musculoskeletal injury resulting in a solider medically not ready to deploy can have devastating effects on the integrity of the team."[11 (p 2949)]

The prevalence and etiology of injuries in civilians have been published in the Canadian Community Heath Survey, summarized by Billette and Janz.[12] In this review article, the authors report that between 2009-2010, approximately 4.27 million Canadians aged 12 years and older reported an injury severe enough to limit their usual activities, representing 15% of the total Canadian population. The article reports the cause of injuries in Canadian civilians aged 20-64 as: sport/physical exercise (29.1%), followed by work related injuries (18.3%) and household chores (16.6%). Most common injuries for Canadians aged 12 years and older were sprain/strain (53.8%), followed by fracture (14.3%). The main injured body part was the ankle/foot (21.1%), followed by the wrist/hand (16.3%), knee/lower leg (15%) and the lower back/lower spine (15.9%).

In the armed forces, the magnitude of MSD is also problematic. As of January 2011, for approximately 30,000 SM of the CAF deployed to Afghanistan, 1,859 (6.2%) had an incidence of MSD.[13] Rowe[14] reported that MSD are the leading cause of morbidity in modern armies and the most prevalent source of disability in the CAF. The author wrote that the large magnitude of MSD (58.2%) in a large CAF sample comprised the following locations: lumbar spine (17.6%), knee (17.2%), ankle (12.2%), and shoulder (11.2%). In the CAF, during the 2000-2004 Bosnia deployment, the most prevalent part of body treated in physiotherapy was a lower extremity injury (41.8%), followed by the spine (28.5%) and the upper extremity (21.5%), with the knee being the most common affected joint (17.2%), followed by the ankle (16.1%), the shoulder (14.4%) and the lumbar spine (14.4%).[15] Reported point prevalence of injuries in the Canadian Army (14.4%) was much higher than the Royal Air Force (2.4%) or the Royal Canadian Navy (0.3%).[16]

The magnitude of MSD can be found in most modern armed forces. In the U.S. armed forces, MSD represent more than 2 million medical appointments annually.[17] The point prevalence sustained in sports-related MSD alone was 49%, leading up to 2.7 million days a year of limited duty in 2008.[3] With this type of MSD, the point prevalence in the Marine, Navy, Army and Air Force was respectively 53.0%, 41.4%, 56.6% and 42.7%.[3] The incidence of lower limb injuries was also reported in the Australian Army, where they were more prevalent (39.6%) than upper limb (19.4%) and than spine (15.2%); a similar lower limb injury prevalence was found in South African military recruits (80%) and New Zealand military recruits (up to 51%).[18] Magnitude of MSD varies depending on the different military occupations. For example, a high prevalence of low back pain has been reported specifically for helicopter pilots, and across multiple Navies and Air Forces (between 50.5%-92.0%).[19]

MSD are a threat to the proper functioning of an armed force. For example, the most common reason for U.S. soldiers to be medically evacuated from Operation Iraqi Freedom and Operation Enduring Freedom was low back pain (53%), and only 2% of the medically evacuated returned to combat.[20] During the U.S. mission to Iraq from July 2004 to December 2010, 84,790 MSD cases were seen; of those 22,431 (26.5%) returned to duty.[21] Rehabilitation time can be another example of a threat for functioning of an armed force. In 2003, in the U.S. Army, 145 soldiers with MSD were followed and the time from rehabilitation to going back to duty was approximately 105 days.[22] Amongst those soldiers, 62/145 (42.8%) reported spending time on limited duty, some of them up to 1,365 days, and almost ¾ of them reported not being able to

perform basic military activities such as running (81%), road marching (80%), jumping down from a vehicle (73%) and carrying a rucksack (73%). Of these respondents, 69% identified they were not able to participate in mandatory unit physical training. In the same Army 6 years later, a study followed the orthopedic rehabilitation of 158 soldiers who were undeployable 3 months before going to Iraq; 53/158 (33.5%) were fit to deploy on time, leaving 99/158 (62.7%) who were unable to deploy 6 months after.[23] Of those, the most common reason not to deploy were that 44/99 (44.4%) became disabled, and 20/99 (20.2%) continued treatments with temporary restriction. Finally, a study from the Israeli Army found low back pain to be associated with absenteeism, low job satisfaction and late return to duty for soldiers, and those not returning to work had significantly higher utilization of health care, including physiotherapy treatment.[24] The magnitude and variation of MSD raises the question of which etiology dominates in the armed forces.

3. NON-BATTLE ETIOLOGY: THE MAJORITY OF MUSCULOSKELETAL DISORDERS IN ARMED FORCES

"... a parallel increase in the ratio of support troop to combat troops, which now approaches 7:1."[25 (p 1916)]

Warfare is changing. At the time of writing, the North Atlantic Treaty Organization forces are transforming their role in recent conflict in mid-Asia from combat to support. Further to this, the populace may hold the common belief that the high majority of morbidity in armed forces is at *prima facie* combat related. This is not accurate. In the CAF, non-battle injuries (such as incidents due to lifting at work), were most prevalent at approximately 18.6% of all injuries.[16] In the U.S. armed forces in 2008, the point estimate etiology of any MSD were exercise and sports at 52.0%.[3] For that same group, Cohen and colleagues[26] wrote that the largest cause of U.S. military unit attrition is non-combat related. Non-enemy related etiology is also seen in a deployed setting. Even during U.S. combat operations, exercise and sports related MSD are the leading cause of medical evacuations.[3] Adams and colleagues[27] reported that for British troops during Operation Resolute, the MSD from weeks 1-19 of the mission had a period prevalence of 11% and 0.3% respectively for sports and battle.

Performing basic military recruit training may also be a common etiology for MSD. In a prospective study on the return to duty of U.S. male Marine recruits having sustained MSD, approximately 6-12% of recruits were injured per month during military basic training, leading

up to 76/166 (45.8%) that were released.[28] MSD may be prevalent however, they rarely occur alone and are often accompanied by Mental Health Disorders (MHD).

4. THE MAGNITUDE OF MENTAL HEALTH DISORDERS

In Canada, Richardson[14] reported the lifetime prevalence of Post-Traumatic Stress Disorder (PTSD) among civilians was approximately 9.2%. This is concerning due to the potential negative interaction between MHD and return to work in civilians.[29] Indeed, civilians with MHD that were away from work were away for longer than any other cause, MHD being one of the leading causes of work absenteeism,[30, 31] possibly due to increased withdrawal behavior, lack of job maintenance and inability to return to work.[32]

In the armed forces, MHD are at similar magnitude. In 2013, in the regular CAF, major depressive disorder was reported at 8.0%, PTSD at 5.3%, generalized anxiety disorder at 4.7% and panic disorder at 3.4%.[33] In the CAF, Richardson[14] reported lifetime prevalence rate of PTSD being 7.2%. In the U.S. Army, MHD were the 2nd leading reason for seeking medical treatment (15%) and, combined with neurological disorders, represented 11% of Army releases,[6] and a prevalent cause of medical evacuation.[34] In a study performed with Sri Lanka Air Force personnel (n=76), the most prevalent MHD were stress/adjustment disorder (25%), followed by anxiety (9.2%) and schizophrenia (5.3%).[35]

War zone and combat are notorious for increasing the rate of MHD. Brukner and colleagues[18] wrote that deployment (including peace keeping missions) may lead to MHD such as fatigue, depression, substance abuse, PTSD and suicidal ideation, which negatively impacts rehabilitation. In the CAF, Jetly and colleagues[14] reported that combat stress, acute stress disorder and PTSD account for at most 50% of the cases of MHD reported in warfare. St.Cyr[14] reported the lifetime prevalence rate of PTSD as 11% in a CAF deployed setting.

The negative effect of MHD on duty can be quite clear. U.S. veterans with PTSD present with poorer health status, a higher amount of physical health problems and occurrences of seeking for medical care, and risk of developing anxiety; leading to depression and/or substance abuse, negative effect on personality and poor overall function.[36] In the U.S. armed forces, PTSD and comorbid pain has been associated with significantly higher rates of health care utilization and worse prognosis for return to duty, than either diagnosis alone.[37] In a study with U.S. Iraq war veterans, PTSD was significantly associated with lower ratings of general health, increased

severity in somatic symptom, and increased amount of sick call visits, missed workdays and physical symptoms.[38]

5. COMPOUNDING FACTORS OF MORBIDITY

Both MSD and MHD often compound resulting in a reduced function and increased morbidity in SM. For example, SM presenting with PTSD have a high prevalence of pain, potentially resulting in a low return to duty rate in the U.S. armed forces.[34] Barrett and colleagues[39] indicated that over 90% of the Gulf War veterans presenting with PTSD had MSD, such as pain, compared to less than 50% of veterans without PTSD. Metabolic morbidity is also a factor that can compound disability, which is a concern for the effectiveness of the armed forces. For example, being obese may lead to the inability to function physically during an annual physical fitness evaluation. In the regular CAF, up to 25% of SM reported being obese.[40] In 2012, amongst the 187 participants of the CAF warrior fitness training program (individuals that failed their annual physical fitness evaluation), more than 50% reported being overweight or obese.[41] A study by Peake and colleagues[42] suggested that Australian SM that are obese have a significant higher period prevalence of injuries (50-60%), significantly higher productivity losses from restricted work (22%), including significantly higher cost of hospital visits and consultation with medical specialists and medical scans. The authors concluded that obesity in the defense "can potentially disrupt military readiness, workforce maintenance and productivity - all of which are integral to effective service provision."[42 (p 457)]

6. UNDERREPORTING

"Many service members do not wish to acknowledge psychological symptoms, often due to the perceived stigma of seeking for mental health care."[43 (p 929)]

The stigma around SM being ill or injured is problematic. For the CAF in 2002, Fikretoglu and colleagues[44] reported that in a cohort (n=293) of SM presenting with MHD, 84.0%-96.5% did not think they needed care. The authors suggested that this potential denial could be due to the stigma attached in MHD, and suggesting that the other most common barriers to seeking care are of resources, time and mistrust in the military. Underreporting of back pain symptoms in the U.S. military is common, due to the concern of appearing frail.[45] In a U.S. Army reserve cohort (n=154), more than 80% of participants without a documented history of back pain reported symptoms over 18 months of monthly observation, yet more than 97% of these soldiers continued to deny having back pain on their annual medical physical.[45] It is possible that, at

certain times such as high-readiness, SM may be less inclined to seek medical care due to the potential inability to be deployed. This raises the question if underreporting can be generated by the potential threat of financial loss for the SM.

7. FINANCIAL LOSS AND GAINS IN DISABILITY

If SM becomes ill, injured and cannot perform like their peers, they tax the defense medical system, limiting the ability of other beneficiaries to receive care and increasing the utilization of administrative ressources.[46, 47] The U.S. military health system is a $40 billion per year enterprise that provides occupational medicine, training, and research for 9.2 million eligible beneficiaries.[48] In the U.S. in 1994, the average cost of a standard recruit training for 20 weeks, that is released after 3-6 months, was $20,733 per soldier; that year the Army paid $500 million in disability benefits.[46] In 2000, the compensation expenses in the U.S. Army were close to $1.5 billion in direct payment (30-50% of those cases could be due to injuries).[49] The financial loss becomes clear given that the cost of retraining special operation and highly skilled SM can exceed $1 million.[20] In the British Army, Neal and colleagues[50] indicated that approximately 3,000 soldiers receive MHD treatment per year, of those, approximately 260 become psychiatric in-patients. In these patients, decision on retention following successful treatment and release from psychiatric hospital can take up to 2 years, estimating the cost of this period at approximately £3 million per SM for continuing to employ/retrain them despite being operationally unfit and admitted to a psychiatric hospital.

Financial gains due to disability are well documented in the literature, although there may be contention as to whether obtaining compensation is an incentive to acquire a diagnosis/treatment. Contextual to a specific population, compensation can have an effect on return to work outcomes. For example, compensation was a predictive outcome of return to work in civilians with non-specific low back pain.[51] In the armed forces, secondary gain of medical compensation post-surgery was present in lumbar disc surgery, but not in cervical disc surgery.[52] Contrary to this, Carragee and colleagues[45] found that compensation in financial gain did not change the point prevalence reported from soldiers with back pain. Readers wanting to learn more about the financial loss and gain mechanisms for CAF veterans can refer to the work of Buitenhuis[14] and Aiken.[53]

8. MEDICAL RELEASES FROM THE ARMED FORCES

The costs for SM injured in the line of duty include a decrease in duty time and combat readiness; and an increase in direct medical care, disability payments, moral costs, and training/retraining.[46] As a result, chronic medical disorders that prevent SM from remaining operational can lead to medical releases from the CAF.[54, 55] In 2009, approximately 4,000 SM were leaving the CAF annually and of those, approximately 20% (800) were medical releases.[54] In January 2011, approximately 147 (8%) of the CAF nationally reported injuries were severe enough to lead to a career release.[13] Pickrell Baker and colleagues[14] reported that 1,142 CAF soldiers were released due to complications of PTSD in 2005. Larsson and colleagues[56] studied enlisted Swedish conscripts and found that having MSD, being overweight and self-rating high MHD, were significant predictors of premature release. The authors also reported that in some military units, up to 32% of the SM were prematurely released. In a follow up study, Larsson and colleagues[57] found in a sample of 862 young male soldiers, the primary 3 reasons for release were (in order of recurrence): 1) MSD, 2) MHD, and 3) medical. In the U.S. Army, the single most common reason to release was disability associated with persistent pain, accounting for 53% of all releases during 1994.[37]

Presence of specific diagnoses may respond to return to duty more favorably than other diagnosis. Cardiovascular disorders,[58, 59] cervical disk arthroplasty,[60] posterior lumbar interbody fusion,[61] transforaminal lumbar interbody fusion,[62] highly selective vagotomy,[63] 2nd degree ankle sprain,[64] burns,[65] and nephrolithiasis[34] are all diagnoses with an approximate return to duty rate between 21%-95%. Knowing there are multiple contextual differences in between these studies, the mode return to duty rate was ≥63%. On the contrary, return to duty outcome may be less likely with other diagnoses. Being medically evacuated for appendicitis, spinal pain or MHD can lead to a low return to duty rate.[34] In the U.S. Army, only 14% of the SM that suffered neck pain needing medical evacuation between 2004-2007 returned to their units.[66] Furthermore, retention of SM with limb amputation is a rare event in the armed forces. In the CAF, approximately 30% of the small number of amputees returned to duty and of those, approximately 10% were redeployed.[13] From October 1980 to September 1988, only 11/469 (2.3%) U.S. amputees soldiers returned to duty, most of the ones that did had partial amputation (hand or foot) and were rarely amputated below the knee.[67] A retrospective study from October 2001 to July 2011 examined outcomes for U.S. military amputees.[68] Of 878 SM that sustained an amputation, 16 (1.8%) were fit to return to duty (all had lower extremity amputation) and 75 (8.5%) were eligible for continuation in a limited capacity or in a new

occupation. Variation of return to duty rates amongst amputees could be dependent on the military occupation. For example, U.S. Special Forces operators that had sustained an amputation were more likely to return to duty, but the overall return to duty rate for all amputees remained low at approximately 11%.[69] In Britain between 2001-2008, the Headley Court Rehabilitation Center treated 52 amputees and amongst those, 33 (63.5%) returned to military service, but only 4 (7.7%) deployed on combat operations afterwards.[70] In this case, it could be argued that the high reported return to duty rate was due to a smaller sample.

9. MALADAPTATION OF UNEXPECTED TRANSITION FROM THE ARMED FORCES

In Canada, "Young, healthy soldiers in the prime of fitness who become disabled after illness or injury can experience a powerful sense of loss of identity and health, leading to feeling "broken"..."[71 (p 1086)]

Overall, reintegration was reported to be difficult especially for the SM presenting with MHD.[31, 54] In the CAF, it is estimated that as many as 35,000 SM will be leaving in the next 5 years,[72] and approximately ⅔ of the attrition are voluntary releases.[73] This leaves a high number of SM that will experience compulsory transition to civilian life, where such a situation can be challenging. In the CAF, unexpected transition to civilian life has been described as difficult and full of struggles, and can lead to "loss of the military family and the member's identity; disorientation in an unfamiliar civilian world; a period of readjusting to being with family full-time; and difficulty finding a family physician in a new the community."[54 (p 159)] Cohen and colleagues[74] reported that U.S. combat veterans ≥40 years of age were known to have a greater than a 2 fold increase in the prevalence of unemployment (n=169). A cross sectional study on 171 U.S. soldiers undergoing release to the civilian world identified that self-esteem and career resilience were partially inversely related to harm appraisal of the transition.[75] In the United Kingdom, transition to civilian life following a brain injury was also reported as problematic for the SM, resulting in career struggles, depression, suicidal ideation, substance abuse, isolation, and marital issues.[76] Maladaptation of unexpected transition out of the military being prevalent and concerning, the armed forces has interest in maximizing return to duty initiatives.

10. REHABILITATIVE INTERVENTIONS IN CIVILIANS

Rehabilitation providers have the responsibility to provide effective treatments, and must recognize and maximize the different components that positively impact a program. A systematic review found that regular physical activity was moderately more effective than

controlled interventions (no treatment or comparator) for reducing symptoms of depression.[77] Those results are in line with smaller size studies suggesting that physical activity is an effective first treatment for depression.[78, 79] In addition, health literacy can be effective component of rehabilitation; where patients lacking in this were found to have worse self-management behavior (body weight management, participation in physical activity) than those who had a sufficient amount.[80] Furthermore, a review pertaining to cancer patients suggested that return to work interventions involving physical training, in combination with patient education, vocational counseling, and training of coping skills led to a higher return to work rate than usual care.[81] Of note, a systematic review identifying the benefits of physical conditioning for return to work in participants with low back pain found no evidence that targeted physical conditioning for return to work may help with a reduction in sick days.[82] In this study, the authors suggest that the effect of graded exercises and work conditioning on the amount of sick days after a 12-month follow-up for the population of workers with chronic low back pain was uncertain.[82] Setting aside the conflicting evidence, those examples demonstrate how the various components of an intervention can be delivered in a team forming an interdisciplinary program.

Interdisciplinary chronic pain rehabilitation programs (consisting of physical therapy, occupational therapy, cognitive behavioral therapy and physical exercise) are examples of effective rehabilitation. Modeled on sports medicine, the primary goal of these interventions is to restore/maximize function in the participant.[37] This patient-centered approach is the desired standard in rehabilitation and is integral to various spheres of rehabilitation such as MSD, low back pain, polytrauma, cardiac and pulmonary.[29, 30, 83-86] Rehabilitation disciplines working together in a team have been shown to be effective for clinical outcomes in stroke, traumatic brain injury, hip fractures[87-90] and for return to work participants with low back pain.[91-93] In low back pain, the efficacy of rehabilitation often comprised multiple health disciplines (physician, occupational therapist, kinesiologist, team coordinator) all working together with the same intentions for outcome.[94] A review performed by Momsen and colleagues[95] found that team-care in rehabilitation was effective in improving rehabilitation in 10/12 various study populations including acquired brain injury, chronic pain, chronic arthropathy and low back pain.

The interdisciplinary portion of an intervention may be delivered in a package, such as an employment program, leading to increased positive outcomes. Return to work rate (full or part-time, independent of wage) with severe MHD increased from 23% to 60% when supported employment programs were available.[31] In addition, Loisel and colleagues[32] reviewed 15 return

to work interventions in disabled populations with mixed MSD. The authors found more than 5 studies that clearly supported the following interventions: cognitive behavioral approach, education to promote self-care and pain management, exercise programs, team based approach and return to work coordination or case management. Kamper and colleagues[96] found that biopsychosocial rehabilitation programs were moderately more effective than usual care for participants with chronic low back pain. The same study suggested that those programs were more effective than physical treatments alone for decreasing work absenteeism in participants with chronic low back pain. This suggests that interventions should be tailored to support a wide variety of participant presentations. Overall, those models of rehabilitation may be well suited for civilian population however; the discussion on their effectiveness in military population is warranted.

11. REHABILITATION INTERVENTIONS IN ARMED FORCES

Interdisciplinary rehabilitative interventions are also superior for military care. The integration of allied health in military rehabilitation can be tracked since the Great War, with the involvement of physiotherapists and occupational therapists.[21, 97-101] At the Walter Reed Army Medical Center, soldiers receive all-encompassing care including physical and occupational therapy, social work and psychology.[102] The British model of an intensive 6-week rehabilitation program is conducted at the Headley Court Rehabilitation Center, where British SM participate in a short and intensive bout of rehabilitation.[13] In the French Army, war-rehabilitation is performed as a team including the chain of command and medical team, including social and vocational rehabilitation.[103] The French rehabilitation team works directly with the soldier and their family "in order to recover the soldier's best abilities and maybe permit return to his professional previous function [by using a team] made-up of physiatrist, psychiatrists, and chain of command, combining their knowledge and know-how."[103 (p e67)] This program "links the numerous collaborators and improves the existing processes, in order to prepare the individual reinsertion project and to make easier the long term follow up of each soldier."[103 (p e67)] In the Swedish armed forces, an intensive intervention comprising of: practical exercises, classroom instructions, ideal volume of training and progressions, group education and early identification of MHD was statistically significant at reducing premature release (6.1% for rehabilitation and training program group versus 13.1% for low intensity group, n=862).[57] Care for Indonesian SM has been reported as including medical and social rehabilitation, having the capacity for 150 disabled SM, delivering an intervention 2 times a year within a timeframe of 4 to 5 months including physical therapy, occupational therapy, speech therapy, and physical activity, with the

goal of returning to duty if possible.[104] Care for SM in the Indian Army having sustained a spinal cord injury is phasic, and involves early occupational therapy and vocational training.[105]

There are many remaining challenges in determining the correct proportion of all the components in a military rehabilitation program. For example, the debate for the correct ratio of cardiorespiratory fitness versus strength training in the military continues.[6, 18, 106] Historically, aerobic endurance has been a primary focus for physical performance of the military population. Aerobic testing has been widely used such as the 6-minute (min) walk test,[107] however the test has been critiqued for having a ceiling effect in CAF personnel.[13] Controversially, some literature articles suggests that the focus of military physical training should not be on aerobic tasks but preferably on strength/effort.[108, 109] This is because performing extended cardiorespiratory training such as running and marching could negate the effect of weight training for power production.[106] It is hoped that future studies on the correct proportion of cardiorespiratory versus resistance training in military populations can determine how to incorporate these 2 concepts in a single program. For example, SM performing rehabilitation and physical fitness could use combined physical training gauged by fatigue level, regardless of mode of exercise[108] (such as high intensity intervals).[110] The correct proportion of all components of military rehabilitation highlights the complexity in the design of such an intervention. Moreover, it is a reminder of the challenges of grouping SM with the same characteristics into an intervention.

12. HETEROGENEITY IN DIAGNOSIS OF REHABILIATION PARTICIPANTS

"Just as we are moving away from the "homogeneity of pain patient myth" and towards attempts to match treatment to specific outcomes of patients..."[111 (p 331)]

In rehabilitation research, understanding the effects of heterogeneity in diagnosis is important, since various disorders can influence outcomes. Operationally defined, a rehabilitation research experimental group is heterogeneous when there is a certain degree of variation in diagnosis/severity between the participants. Gatchel[111 (p 331)] wrote that:

> "[p]atients with the same medical diagnosis of set of symptoms (e.g., chronic low back pain) have traditionally been "lumped together" and then treated in the same manner, as through "one size fits all." However, it has been shown that pain patients with the same diagnosis can have different responses to the same treatment. This will be similar for different subgroups of spinal lumbar patients (e.g., workers' compensation, private-pay insurance, older patients, etc.)..."

Examples of heterogeneity found in rehabilitation research are numerous. Pedler and colleagues[112] found that whiplash injuries could be divided into 4 clinically relevant clusters depending on the degree of post-traumatic stress symptoms and sensory hypersensitivity. The authors found that one cluster in particular, comprising 43.5% of their total sample (n=331), had significantly worse disability, pain intensity, MHD and less cervical range of motion in comparison to the other clusters. Fishbain and colleagues[113] studied a sample (n=283) of chronic patients that had low back, cervical, abdominal, chest or headache related pain. This study reported that up to 35% of the sample had a secondary diagnosis (such as degenerative disease of the spine), up to 62.5% had a non-physical diagnosis (such as anxiety), and up to 59.0% had personality disorder (such as paranoia).

Nevertheless, heterogeneity in research remains a source of controversy. High variability in the characteristics of rehabilitation participants has been reported to potentially result in lack of precision in the study, reduced effectiveness for clinical trials and a threat to internal validity.[114] Historically, experimental rehabilitation research was performed with minimum variability in diagnosis, as heterogeneity was thought to impede validity. As a result, randomized controlled trials became the so-called gold standard in experimentation of rehabilitation studies. Contrary to this, some authors support that there is no best design. Regarding the *sine qua non*, Carter and colleagues[115] wrote that randomized controlled trials are not the best design to determine the treatment of choice for a specific patient. The authors explain that the results of randomized controlled trials are based on average scores for all participants, lacking information on individual performance. Specific to pulmonary rehabilitation, Spruit and colleagues wrote that "…it is not clear whether extrapolating evidence from randomized controlled trials designed around a particular model of pulmonary rehabilitation may be generalized to other models."[83 (p 1334)] Therefore, in some rehabilitation experiments, grouping participants based on similar characteristics, or diagnosis, may be a concern. Results from experimental research should be as close as possible to the population where generalizability is hoped.[115] Therefore, external validity becomes a fine balance between low-variability in participants versus their representativeness of the population of interest.

In civilian work claimants, the actual diagnosis is of secondary importance in recovery since the participants can be chronic and work outcomes are determined strongly by psychological factors such as work recovery expectation (despite the presence of MSD).[116-119] A parallel could be drawn for SM attempting return to duty. Consider the example of rehabilitation research on the return

to duty of an injured military unit. In an Army unit, a section is approximately 20-30 SM with a high degree of variability in their age, gender, occupation and health status forming a highly heterogeneous group.[110] The sole goal of an Army section is to work together to succeed in missions, and to leave no one behind. A rehabilitation study on return to work in a military population may find strong external validity in recruiting participants resembling such group.

13. ADMINISTRATION OF MILITARY PERSONNEL

The administration of SM is not a simple task in the armed forces. The timeline for returning to duty can be long in duration, for both the armed forces and the SM. Malish and colleagues reported that U.S. "[s]oldiers can become lost within the labyrinth unless they adopt a proactive approach to both learning the intricacies of the process and ensuring timely appointment."[120 (p 715)] In their paper, the authors present a workflow of medical decision in relation to duty; a system of medical classification (physical capacity, upper limbs, lower limbs, hearing, eyesight, mental function and stability) allocates a grade to the SM that reflects their functional ability to work. In Britain, the Joint Medical Employability Standard records the functional capacity of the service personnel and transposes this information to duty readiness.[121] In this system:

> "[s]ervice medical officers, who understand the demands of life in a military environment and work closely with their patients' employers, are able to influence directly a person's employability and recommend modifications and restrictions to either work until such time as they are fit to resume full duties."[122 (p 1187)]

British SM can be "downgraded", either temporary or permanently, the latter leading to a release because they were assigned a medical category.[123] In the Swedish armed forces, the system is also complex resulting in ambiguous reasons for release and problems of classification, primarily due to a lack of formal system.[56]

In the CAF, the Military Personnel Command is a large organization that amongst many roles provides medical care, rehabilitation and return to duty for the SM.[124] To operationalize this immense task, the Commander of Military Personnel Command regulates the following directorates of interest, which administer the SM to retention or release: 1) Directorate of Medical Policy (DMedPol) 2) Directorate of Military Careers Administration (DMCA) and 3) Directorate of Military Careers (DMilC). The detailed functioning of those directorates are described primarily online.[55, 125, 126]

In summary, the Universality of Service (U of S) is the global standard of function to which all SM in the CAF must comply.[125] Failure to comply with the U of S inevitably leads to CAF career implications. To rate medical function, a range of number from 1 to 7 is attributed to different factors: Vision (V), Colour Vision (CV), Hearing (H), Geographic (G), Occupational (O) and Air (A).[125 (Annex A)] Factors hold a different range of numbers but all together, they form a statement to allow the CAF chain of command to employ/deploy SM.[125 (Chapter 2)] Factors capture the general age and health status including morbidity; higher numbers can be a common reason for CAF release. The most relevant factors are G, O and A and consequently, compose the highest capacity to rehabilitate. The factor A is inconsequential for SM not employed as aircrew (in this case automatically assigned a 5). There are different G and O thresholds for CAF occupations, ranging from 2-3. Factors 1-3 correspond to low/no duty restriction, and 3-5 can indicate a breach of the U of S. As an example, a very young, uninjured soldier could be: V1 CV1 H1 G1 O1 A5. The category: V2 CV2 H1 G3 O4T6 A2 means this person is temporarily not employable in their occupation for 6 months. The category: V1 CV1 H2 G5 O3 A2 means that this person cannot be deployed (due to the G5).

In the CAF, the process starts when an SM is ill or injured. During the evaluation, the CAF clinician may assign Medical Employment Limitations (MEL)[125 (Chapters 3 and 4)] according to the following principles:

1) Protection of the health and safety of the SM;
2) The functional impact of a medical condition on the ability of the SM to perform duty;
3) The frequency and level of care required, considering the risk of recurrence of a medical condition and its consequences.

MEL are a list of statements describing possible work limitations, and according to their complexity/severity can be career-limiting.[125 (Annex E), 127] MEL are often temporary (6 to 12 months) and are issued locally where revaluations are performed on an individual basis. Non-complex MEL are reviewed locally by the commanding officer. Beyond 12 months, the medical standard group at the DMedPol assigns permanent MEL. Once sent to the DMCA, permanent medical category triggers an administrative review, where the DMCA determines if MEL are at high risk of breaching the U of S. Career-limiting MEL can increase the numbers on the factors in the medical category. The DMCA performs an administrative review and verifies whether SM are at risk of breaching the U of S. “Should wear prescribed lenses” is an example of benign MEL, while “cannot perform drill and parades” is an example of career-limiting MEL. Persistent

MEL may lead to a temporarily posting to the Joint Personnel Support Unit, where the purpose is to recover, rehabilitate and reintegrate SM.[128]

The DMCA regulates CAF careers using MEL information provided by the DMedPol. The DMCA determines if the member breaches or does not breach the U of S and initiates 3 steps: 1) advisory message, 2) disclosure/representation and 3) decision. The advisory message notifies the SM that their file is under review, and may suggest a period of retention. In due course, a disclosure package is sent, stating that the administrative review is conducted and if the MEL breaches the U of S or not. SM can provide personal representation, agreeing or disagreeing with the information in the disclosure package. In due course, the DMCA issues a decision, which could include a date of release. An example could be the DMCA stating that SM can remain in the CAF but not under their current occupation. In this case, another CAF occupation (that can accommodate the MEL) will be assigned.

The DMilC manages CAF careers and work positions. It also approves postings for SM retained with MEL, wherein a Personnel Selection Officer may cross reference with CAF available occupations.[127] Retention of SM presenting with career-limiting MEL is only possible when there is a critical shortage for a specific CAF occupation, or when a unique skillset is present. Five possible outcomes can happen: 1) return to duty in the same occupation without restriction, 2) return to duty in the same occupation with restriction, 3) return to duty with a compulsory occupational transfer, 4) period of retention of 1-3 years, 5) release (usually takes between 6-36 months). The first 3 outcomes are considered a successful return to duty in the CAF. An abridged logic model of the interaction between CAF directorates is depicted in Figure 1.

Figure 1: Abridged logic model of Canadian Armed Forces administration of military personnel

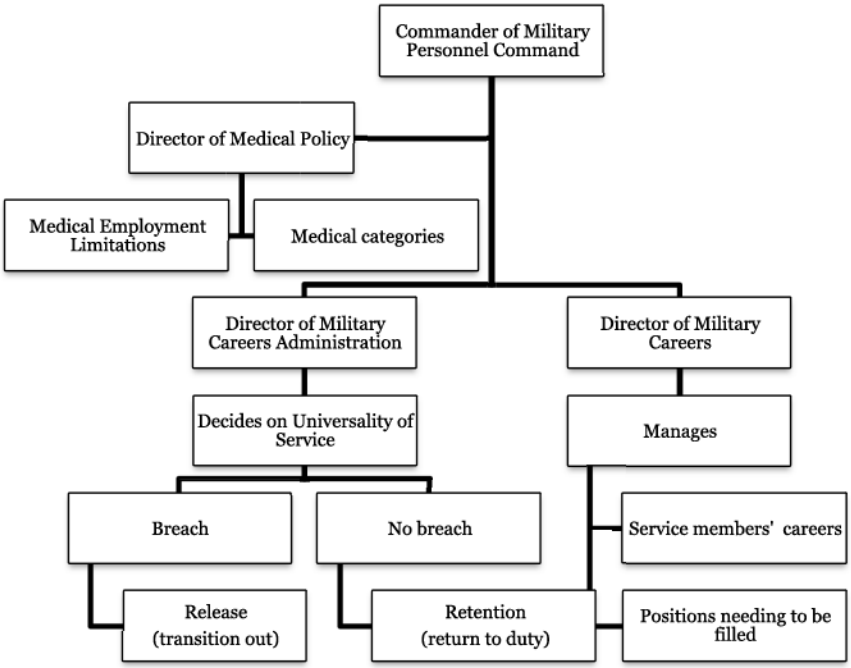


Figure 1: An abridged logic model of how the Canadian Armed Forces is administering its service members for retention/release.

14. INCEPTION OF A NOVEL INTERVENTION IN THE CAF

In January 2013, local discussion at the 3rd Canadian Division Support Base Edmonton was initiated among stakeholders regarding ideas on developing a return to duty intervention. The goal was to have a collaborative program with all partners under the same target outcome. Rossi[129] suggested that to assess the impact of a program, one must conduct observations/interviews focusing on the target-program interaction that are expected to produce the intended outcomes, that pilots/full-scale projects can have a considerable amount of differences prior to implementation and that over-sophistication might lead to failure.[129] In this case, the target-program interaction was return to duty. Opinions from stakeholders were discussed regarding what an interdisciplinary intervention should be, and scheduled group meetings were attended. Feedback from SM, clinicians, policy makers, and chain of command were considered and iterative pilots were conducted. The goal of the 2 iterative pilots[130, 131] was to collect preliminary observation to perform an assessment of the feasibility of the intervention. Initially, the pilots were rudimentary and comprised a selection bias,[129, 132] resulting in compromised validity. Indeed, the participant selection was done without considering their likelihood of breaching the U of S. Understanding how the CAF administers SM (chapter 13), the

pilots could contain many participants with a strong likelihood of release from the CAF because the sampling was exclusive to the Joint Personnel Support Unit[128] (an temporary unit for injured or ill SM with chronicity). Hence, the final selection was narrowed to participants with an uncertain prognosis (Chapter 16, section 2.3). Overall the final intervention resulted from the partners' reflection on the 2 previous pilots, and subsequent improvements on the design and delivery. As a result, the team created an intervention using the steps recommended for program impact theory published by Rossi[94, 129] and depicted in Table 1. Improvements were made from the pilots, resulting in the final version called the 'Return to Duty intervention' (RtD).

Table 1: Steps for program impact theory (adapted from Rossi)

Steps	Program Impact Theory	Return to Duty intervention
1	Analysis of unpublished documents	Analysis of the Canadian Armed Forces medical category system online with forms: • Canadian Forces 2016 - Progress Notes • Canadian Forces 2018 - Employment Limitations for Return to Work Worksheet • Canadian Forces 2088 - Medical Employment Limitations
2	Analysis of scientific literature	Scoping literature review on return to duty in armed forces
3	Interviews	Non-structured, individualized consultations with stakeholders (researchers, clinicians, policy makers, service members, chain of command)
4	Group discussions	Scheduled meetings on developmental evaluation with stakeholders and practitioners
5	Observation of program reality	Two pilots, using exit interviews and satisfaction questionnaires
6	Development of a final version of the program	The Return to Duty intervention (RtD)

The first component of the RtD is the physical training. The choice of exercises was initially made from the needs analysis of the Fitness for Operational Requirement of CAF Employment (FORCE) evaluation[127, 133] (Appendix 1), and its breakdown into primary movements (Appendix 2). An activation of 10 min was designed with a composite of published exercises,[134-140] and remained identical for 10 weeks (Appendix 3). From the basic movements, a physical training plan was made (Appendix 4) from www.DFit.ca, allowing for a wide range of exercises that are known in the CAF. Efficacy of www.DFit.ca has been demonstrated in the CAF.[141] This process of exercise selection for the RtD is depicted in Figure 2.

Figure 2: Exercise selection

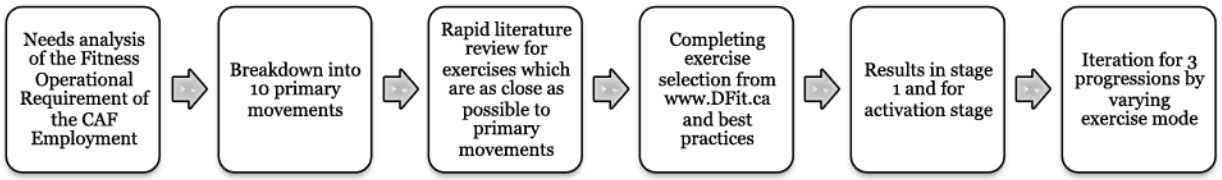


Figure 2: The creation of the physical training portion of the Return to Duty intervention.

Basic movements remained similar throughout the program progressions however 3 benchmark sessions occurred, representing a point at which progression of the exercises would occur (underlined in Figure 3).

Figure 3: Progressions showing benchmark workouts and end point

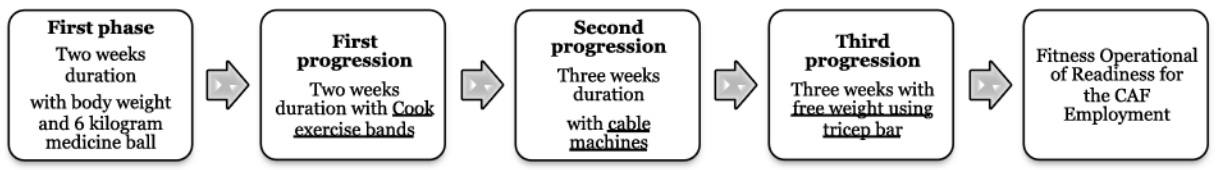


Figure 3: The pathway of physical training progression during the 10-week Return to Duty intervention.

In the first 2 pilots, the participants received an individual physiotherapy screening. Screening tests performed were: Selective Movement Functional Assessment,[142] ankle lunge test[143] (for general physical function and pain); and slump test/straight leg rising[144] (to detect intervertebral disk pathologies). The rate of new injury detected by screening during the iterative pilots was reported at 0% by the physiotherapist, and changes in measures were modest.[130] It was decided as a team that having a physiotherapy screening was not necessary however, the physiotherapist would remained as a standing clinician, where participants could walk-in as needed. After team consultations, a reduction in the volume of exercises (from double to a single circuit) was implemented to increase exercise adherence. Furthermore, some adaptation of exercises was implemented following the feedback from the participants. For example, exercise #31 in Appendix 4 was improved by using a step so the participants stands higher and obtains more range of motion during squat movement. Adherence to the pilots was acceptable, but the actual adherence reporting was poor. Pilot 1 used www.DFit.ca for reporting and as a result, the adherence to the reporting itself became a major issue. Reporting was also irregular for pilot 2 but improved since simple hard copy, pocket size logbooks[145] were used.

The health and work literacy was the 2nd part of the RtD, and consisted of group education for 60 min once a week. Following the RtD morning physical training sessions, the participants were directed to a classroom. The material was delivered using videos, discussions, assignments and presentation with Microsoft PowerPoint (Microsoft Corporation, Redmond, WA). Developmental evaluation led to the incorporation of multimedia and an expanded content with more emphasis on goal setting, stress management and mindfulness. Topics were developed by the CAF staff (occupational therapist, dietician and kinesiologist) and related to using self-regulation strategies for pain, sleep, exercise, nutrition and cognitive performance.[94, 131] The topics improved between the pilots, and resulted in the format shown in Figure 4.

Figure 4: Health and work literacy topics

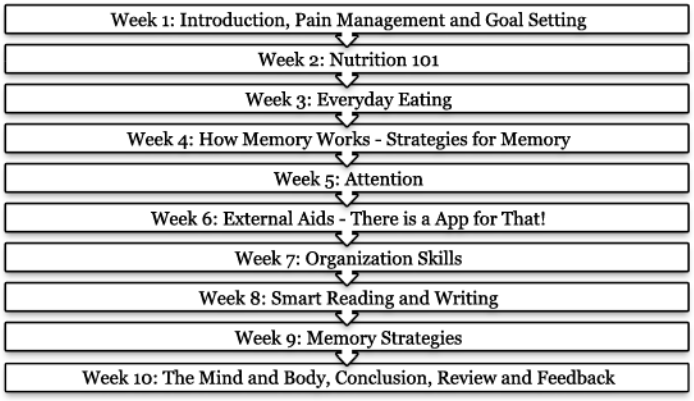


Figure 4: The topics for the health and work literacy component of the Return to Duty intervention. Participants received 60 minutes a week in a group setting for 10 weeks (content reproduced with permission from the work of Chelsea Jones).

Before the participants started the RtD, an individual information letter was sent to their respective CAF care delivery unit. This confirmation letter (Appendix 5) would be received by the medical staff attending the participant, and stated the enrollment in the RtD for 10 weeks. Throughout the RtD, attendance to sessions, compliance to exercises and participant feedback was documented. At the end of the intervention, a standardized progress note (Appendix 6) was sent back to the same address, informing the medical staff regarding RtD completion or dropout.

15. MULTIPLE BASELINE DESIGN: A ROBUST SINGLE SUBJECT RESEARCH

"Single-subject research design [...] is a valuable clinical research tool. Properly used, it can inform and illuminate clinical practice."[146 (p 1145)]

The Single Subject Design (SSD) was first introduced approximately 60-70 years ago[147, 148] and is defined as an "...intensive and prospective study of the individual, using a priori methodology, which includes systematic observation, manipulation of variables, repeated measurement and data analysis."[149 (p 387)] Repeated measurements of the functioning of participants in relevant domains throughout a treatment is the bedrock of SSD.[148] The SSD can deal with abstract concepts such as treatment efficacy,[145, 150] and is the most useful and powerful non-randomized design.[151] More importantly, the SSD is as equally valid and more feasible than a randomized control trial in determining causality in scientific studies.[152] The SSD is highly feasible since it can be variable in duration, economical in cost requiring minimal staffing, flexible to change, participant-centered, and the findings are often utilizable immediately.[145] The SSD is a robust design for heterogeneity due to its individuality in analysis, where the analysis and intervention are done as a "unit" or at participant level.[147, 153]

The optimal choice of SSD lies in the research question,[154] and the Multiple Baseline Design (MBD) has been identified as ideal for the RtD. The MBD is a versatile SSD where the duration of baseline testing is different for participants. It is also an advantageous design where patterns in multiple participants are investigated, and as an alternative to withdrawal designs, given the ethical considerations of not providing an intervention to a participant.[145] The MBD is considered superior to answer questions such as if the intervention works, which elements within a treatment works, and the optimal level of treatment.[155] The core data analysis of any SSD including the MBD is visual inspection.[145, 155-157] As such, 6 different criteria are presented in Table 2, and were applied for the analysis found in chapter 16. The study in chapter 16 solely used notation +, 0 and – (respectively for improvement, no change/ambiguity and deterioration) and as a result, criteria in SSD analysis enhanced the analysis.

Table 2: Criteria of visual analysis

Criterion	Definition	Explanation	Decision
Absolute level change	Change in mean measured with a Δ-index ≥0.87 $\text{Effect Size} = \frac{\text{mean}_{\text{intervention}} - \text{mean}_{\text{baseline}}}{\text{standard deviation}_{\text{baseline}}}$	Δ-Index is appropriate in the absence of apparent autocorrelation or outliers in the data; a Δ-index ≥0.87 represent at least a moderate effect size	Changed Unchanged
Trend	Direction of the slope from the baseline phase (in relation with the x-axis) compared to the adjacent phases (when present)	Trend following the target value suggest a cause-effect inference	Increasing Absent or ambiguous Decreasing
Variability	Fluctuation/predictability of the level and trend measured when the baseline mean falls outside 1 standard deviation	Less variability suggest a cause-effect inference	Stable Variable
Immediacy	Change in level between the last 3 data points of the preceding phase and the first 3 data points on the next phase	Presence of immediacy suggest a cause-effect inference	Present Absent
Overlap	The mean of a phase overlapping the mean of its preceding or succeeding phase	Less overlap suggest a cause-effect inference	Absent Some Much
Anomalies	Subjective decision on datum showing skewness, outliers and heavy tailed graphs	No anomalies suggest a cause-effect inference	Absent Weeks identified

16. THE EFFECTIVENESS OF THE RETURN TO DUTY INTERVENTION: EVALUATING AN INTERDISCIPLINARY APPROACH TO SUPPORTING CANADIAN ARMED FORCES MEMBERS WHO HAVE PHYSICAL AND NON-PHYSICAL DISORDERS

Summary:

The high number of medical releases in the Canadian Armed Forces has negative implications on productivity, health care costs, and health & wellness for service members. Returning to duty can be a complex process, and standardized interventions are either lacking or not evaluated resulting in suboptimal care for the service members. A pragmatic and standardized approach to return to duty could potentially optimize the retention rate in service members of the Canadian Armed Forces. The aim of this chapter was to determine the effect of a 10-week interdisciplinary work rehabilitation intervention. A single subject multiple baseline design was used to evaluate the effects of the Return to Duty intervention. This intervention lasted 10 weeks, and included

phasic physical training (3 sessions per week, 2.5 hours supervised and 3 hours non-supervised) and 10 group education sessions of 60 minutes (cognition, nutrition, sleep). Service members at the 3rd Canadian Division Support Base Edmonton and at the 4th Wing in Cold Lake with physical or non-physical diagnoses were invited to participate. The primary outcome was return to duty 6 months post-intervention. Function was measured between 3-8 times pre-intervention; at week 3, 5, and 8 during the intervention phase and 3 times post-intervention. Analysis consisted of visual observation of graphed results, along with duty status 6 months post-intervention. Twenty-three subjects in 3 cohorts (n_1=8, n_2=7, and n_3=8) were enrolled. The confirmed return to duty rate was 39.1% at 6 months post-intervention, with an additionnal 34.8% expecting a return to duty but unconfirmed. Return to Duty was an interdisciplinary, pragmatic intervention that could assist the service members as part of their return to duty plan. This novel standardized intervention may help decrease the burden incurred from medical releases in the Canadian Armed Forces. This chapter presents the following:

1. Introduction

In order for the Canadian Armed Forces (CAF) to achieve its objectives, all its components must function adequately. The Service Members (SM) are undoubtedly the most important component of the CAF, and therefore their health is of primary importance. SM are expected to meet the minimum standard of function, the Universality of Service (U of S), a tenet in the CAF.[13, 127] Unfortunately, morbidity in the CAF is prevalent and often precludes SM to meet the U of S. Up to 6.4% of the regular CAF reported their health as fair/poor,[40] and 26% reported as being non-deployable.[158] In 2013, 1,217 SM from the CAF were released, this number being similar yearly.[159] In 2009, the cost for disability benefits was a significant portion of the $3 billion allocated to Veteran Affairs of Canada.[71]

In the CAF, a large majority of morbidity is due to Musculoskeletal Disorders (MSD). Up to 43% of the regular CAF reported having a serious repetitive injury over 12 months.[158] In 2009, 25% of SM accessed physiotherapy services, resulting in 162, 771 treatment sessions.[13] MSD compromises safety in the CAF as it induces difficulty concentrating, fatigue, error and rushing to complete tasks due to the pain.[19] Implications of MSD can include a decrease in health and quality of life, operational effectiveness, military/combat readiness; and an increase in time loss from work, medical release rate and finally, burden on Veterans Affairs of Canada costs. Rowe[14] suggested that in 2009, 5, 711 SM were receiving outsourced physiotherapy treatment sessions due to the overload of patients in the CAF services; reflecting up to $1.7 million of additional, unforeseen costs for that year alone. Every year, approximately 42.1% of the CAF medical releases are due to MSD.[159]

Mental Health Disorders (MHD) are also a prevalent morbidity in the CAF, and can have devastating effects on employability.[160] From the regular CAF, 7.6% reported major depression, 10.4% Post-Traumatic Stress Disorder (PTSD), 2.9% psychological distress, and 3.9% suicidal ideation.[40] Up to 4.4% of SM in the CAF had generalized anxiety disorder, and of those, 44% had a severe work impairment leading to missed days at work.[161] In a cohort of CAF service personnel diagnosed with post-deployment PTSD (n=792), 62% had temporary duty limitations, 15% had permanent duty limitations and 8% had been medically released as a consequence of a service-related MHD.[160] Every year in the CAF, approximately 41.3% of the medical releases are due to MHD.[159]

Extensive health care is available to SM, however the author could not find any publication on a work-rehabilitation program in the CAF. Guidelines and policy were in place however hands-on return to duty approaches in the CAF were a black box.[132] If such intervention would exist, SM may be able to decrease morbidity to meet the U of S and perhaps avoid a medical release. The decision of return to duty in the CAF is a vast and complex process and details can be found elsewhere.[55, 126, 127] In summary, employability and deployability in the CAF is evaluated according to a medical category with 3 factors of interest: Geographic (G), Occupational (O) and Air (A), with an adjacent numerator corresponding to degree of work restriction.[125 (Annex A)] Every CAF occupation has different minimal G and O factors required (ranging from 2-3) to meet the U of S.[125 (Annex E)] The assumption of this study is that a CAF work-rehabilitation intervention may assist SM in improving their function to decrease morbidity to meet the U of S. In turn, this may lower Medical Employment Limitations (MEL)/medical category before a release from the CAF. The Return to Duty intervention (RtD) was a collaboration between stakeholders aimed at increasing function and return to duty of the participants. This study aimed to evaluate the effectiveness of the RtD at assisting participants in lowering MEL/category. More specifically, this study investigated if the RtD participants did return to duty in the CAF, and if they had meaningful improvement in function compared to their baseline status. To answer this, the study had the following objectives:

1. To investigate if the RtD participants returned to duty 6 months following completion (measured by a lowering of MEL/category in relation to minimum required) and;
2. To determine whether meaningful changes in function (physical, non-physical and self-perceived, compared to the participant' baseline status) occurred during and post-RtD.

It was hypothesized that participants of the RtD would successfully return to duty 6 months post-completion. The secondary hypothesis was that meaningful changes in function would occur during and post-RtD.

2. Methodology

2.1 Study Design

This study used a non-response guided Multiple Baseline Design (MBD) concurrent across participants, repeated across setting and time period.[145, 162] In other words, the intervention had a predetermined start date and was iterated identically in different locations and time points (creating 3 cohorts and 2 locations). As depicted in Figure 5, the MBD allows for a flexible start schedule, having a minimum of 3 repeated measures for each of the 3 phases: baseline, intervention and maintenance.[145] Baseline phases were scattered over a period of 4 weeks in

duration allowing for up to 2 repeated measurements sessions a week, totaling 3-8 possible sessions. Participants were assigned an amount of measurement sessions in the MBD design by convenience, based on a consecutive order of recruitment leading to the predetermined start date of the intervention.

Figure 5: Experimental timeline

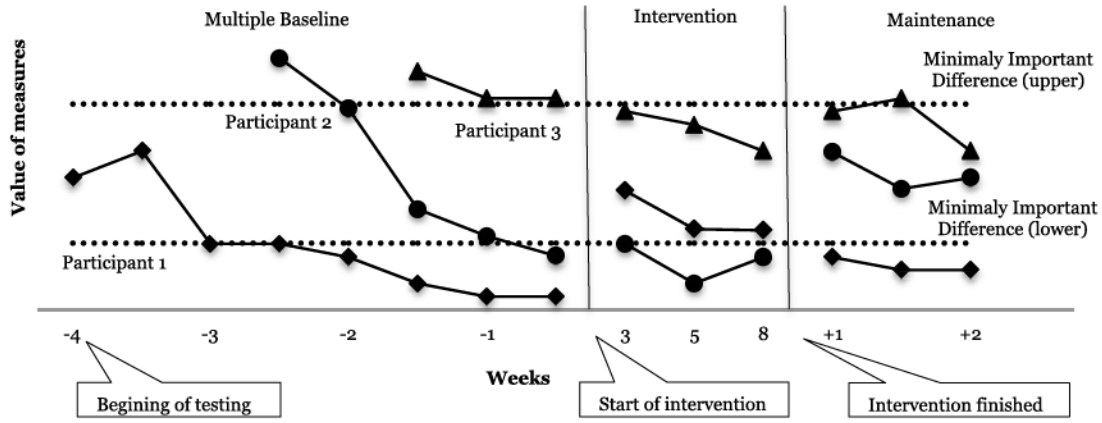


Figure 5: A sample of how 3 different research participants performed testing at identical stages but with a different amount of testing during the baseline. The larger number of participants demonstrating the same response (despite the amount of testing that they received), the stronger the relation between treatment and response can be claimed.

2.2 Intervention

Though the RtD was originally known as 'Return To Force', then as the 'Return To Duty occupational course', it was renamed the RtD and this final term will be used throughout this study. The RtD was a hybrid work rehabilitation intervention,[129, 163, 164] composed of: 1) physical training,[94, 109] 2) health and work literacy[131] and 3) ongoing team support. Models comprising those 3 components in military rehabilitation and return to duty have been shown to be effective in armed forces.[103, 122, 137, 165-170] Having conducted RtD rudimentary pilots,[130] a developmental evaluation was used,[152, 171] evolving the RtD to a group intervention for a duration for 10 weeks, including 1 supervised session per week for both physical training and health and work literacy.[37, 167, 172, 173]

The physical training was performed 3 days a week divided in 3 progression phases of 2-3 week duration each.[109] Exercises consisted of a wide variety of multi-joint repetitions for concentric, eccentric and isometric exercises[138, 174-176] in the sagittal, frontal and horizontal plane[177] (detailed

in Appendix 3 and 4). The exercises were selected from a needs analysis from the Fitness for Operational Requirement of CAF Employment (FORCE) evaluation.[127, 133] The physical training session could be performed within 20-90 minutes (min),[109] providing 3 rest periods during the session.[178] A pocket size logbook[145, 179] was provided to the participants after their 1st exercise session. Attendance to sessions and compliance to exercise volume were shown how to be reported in the logbooks. The health and work literacy component was designed to improve self-management behavior for patients with medical disorders attempting return to work/duty.[32, 80, 94, 99, 180] It included various topics such as coping, sleep, and nutrition in 60 min group classes once a week.

Participants were encouraged to challenge the minimal CAF physical standard, the FORCE evaluation, at any stage during the RtD. Local staff conducted the RtD in-kind, without additional incurred costs to the CAF. Durand and colleagues[181] wrote that rehabilitation and return to work must not occur in a protected setting, but in a quick immersion in normal return to work setting. The RtD was delivered in a semi-private setting during non-peak hours. The participants received no compensations and were asked not to change their physical activity behavior once baseline measures started.[182] Once the RtD ended, participants were directed to book an appointment with their treating CAF physician/nurse practitioners for a revaluation.

2.3 Sampling

SM were referred to the RtD by either a physician or nurse practitioner in the CAF, and then were consecutively invited to participate in the study.[129 (p 192)] SM were eligible when they had MEL persisting for ≥30 days, and excluded[129 (p 192)] if they: 1) had a high likelihood of a medical release (career-limiting MEL determined by the CAF treating physician/nurse practitioner), 2) presented with a diagnosis precluding them from participating in a group intervention (severe PTSD, severe anxiety, severe depression, substance abuse, delusional, hallucinations, suicidal or homicidal ideations), 3) were awaiting surgery precluding them from physical activity, 4) had a fracture healing for 3 months or less, 6) were post-surgical for 6 months or less (major surgery), 7) had current undiagnosed/ongoing conditions that might require further medical clearance (neurological deficit signs and symptoms, cervical/thoracic spine radiculopathy inducing symptoms in thorax/upper extremities), or 8) had a recurrent history of less than 80% attendance to medical appointments. Participation was voluntary. SM invited to participate in the study but that declined could still participate in the RtD. The participants' initial intake[183-185] occurred in a private office where the study was presented verbally, informed consent (Appendix

7) was signed, an information letter was given (Appendix 8), and the Physical Activity Readiness Questionnaire+ was completed (Appendix 9).[185] At the end of the intervention, the referring CAF physician/nurse practitioner received a standardized note in the CAF electronic medical system, stating that SM participated in the RtD and that medical status could be reviewed. Participants could be from either regular or reserve CAF, and from any ranks (non-commissioned and commissioned). This study was approved by the University of Alberta Ethics Board (Pro00045025) and endorsed by the CAF Surgeon's General (E2014-01-137-004-0001).

2.4 Measures

The measures collected for each participant are listed in Table 3 and were categorized according to the ICF-10 (International Classification of Functionality, Disability and Health)[186] with the following classifications: Body Function/Structure, Activity, and Participation, with notation of personal or environmental factors where appropriate.

Table 3: Return to duty measures

Outcome	Time point	Measure		International Classification of Functionality, Disability and Health
			Acronym	
Primary	6 months post-intervention	Change in Medical Employment Limitations/ Medical category	MEL/ Medical category	Activity, Participation, Environmental
Secondary	Repeated measures: pre, during and post-intervention	Four Squares Step Test	4SST	Activity
		Five Times Sit-to-Stand Test	5TSST	Activity
		Body Fat		Body Function
		Handgrip		Body Function
		Patient Health Questionnaire-9 items	PHQ-9	Body Function, Activity
		Patient-Specific Functional Scale	PSFS	Activity, Participation
		Work Ability Index (abridged)	WAI	Participation
		Waist Circumference		Body Structure
	Global health questionnaires: pre and post-intervention	Short Form-36 questions version 2 Health Survey™	SF-36v2™	Activity, Body Function and Structure, Personal
		Outcome Questionnaire® 45.2	OQ® 45.2	Body Function, Structure, Personal

2.4.1 Primary Outcome: Returning to Duty

In the CAF, the treating physician or nurse practitioners assign MEL/category. The threshold for returning to duty is the minimum factors required for the SM occupation, and MEL that will not breach the U of S. For this study, any change in G, O and A factors from pre to 6 months post-RtD (in relation to the threshold required for the occupation[125 (Annex E)]) were extracted from the electronic database Canadian Force Health Information Service. The factor "A" is inconsequential for a non-flying occupation, and therefore was noted only when it was found to be career-relevant. Return to duty was therefore defined as a lowering of MEL/category to the CAF occupation threshold, 6 months post-RtD (ICF-10 P).

2.4.2 Repeated Measures

Measures were chosen from potential mediators of the primary outcome, where their presence can influence return to work/duty. All repeated measures were administered by trained CAF staff, accredited by the Canadian Society for Exercise Physiology.[185] Participants were measured early in the morning (with a few exceptions for catch up sessions) and were asked to withhold fluids intake prior to testing.[187] Except when mentioned otherwise, the RtD staff scored all measures. The staff conducting the measures was blinded to the performance of the participants throughout the RtD, and the staff conducting the intervention was blinded to the participant's performance during the measures. For all measures, instructions were read out loud from a standard script (Appendix 10).

The **4 Squares Step Test (4SST)** was introduced more than a decade ago to measure dynamic lower extremity function (ICF-10 Ac).[188] This study used a 4SST protocol previously used with SM,[107] where the participant must jump clockwise and counterclockwise with both feet into intercrossing sticks on the floor that form 4 square shapes. Up to 3 breaks lasting 60 seconds (s) each (in between trials) were allowed as required, results were reported as the mean time to complete each of 4 trials.[107] The 4SST is a robust (valid and reliable) rehabilitation metric,[188] and its Minimally Important Difference (MID) was identified as 0.3 s for SM.[107]

Csuka and McCarty[189] were first in introducing a sit to stand test as a measure of lower extremity function 3 decades ago. The **5 Times Sit to Stand Test (5TSST)**, has been previously used with SM;[107] the participant starts sitting on a 43 centimeter height chair with arms crossed at the chest, then they stand up and sit back down 5 times as fast as possible (ICF-10 Ac). The 5TSST is a robust metric[190] with an MID of 2.3 s.[191]

Handgrip is a measure of upper extremity function predicting functional limitation and disability later in life (ICF-10 B).[185] More importantly for SM, low handgrip was associated with chronic heart disease/stroke incidence, and premature death from any cause (including cardiovascular).[192, 193] To measure handgrip, this study used the JAMAR® Plus Digital Hand Dynamometer (Metriks, Waterloo, ON), with the handle standardized at the 2nd notch.[194] The device is automated, performing a sound when a hand contraction is required. With the participant standing on a hard surface, feet together with arm alongside the body, measurements were taken with the right side first, in kilograms.[185] The participant was asked to perform a maximal hand contraction for every sound for 1 s duration, at every 1.5 s for 20 repetitions. Participants with hearing impairment were assisted by the staff touching their shoulder with their finger for every sound. The result recorded was the mean of 20 repetitions for the right hand, added with the mean of 20 repetitions for the left hand. Handgrip measured with the JAMAR® Plus is robust,[195, 196] with a reported MID of 6.2 kilograms.[197]

Body fat excess in military population has an effect on function and rate of injuries (ICF-10 B),[198-201] and was identified as a health concern in the CAF.[202] This study used a factory calibrated Skyndex skinfold caliper (Metriks, Waterloo, ON), having an integrated microprocessor instantaneously calculating the 3-sites prediction equation for body fat. The sum of the 3 sites[203] was taken on the right side, always in the same order, twice.[204] The Skyndex and its 3 sites prediction for body fat is robust,[204-206] and a change in 8.6% in any direction was found as MID limits in SM.[207]

Low amount of intra-visceral fat is an important determinant of health[185, 208] including for the CAF[202] and therefore **Waist Circumference** was measured with the Height of Iliac Crest protocol (ICF-10 B).[209] A factory-new Gullick anthropometric tape (Fit Systems, Calgary, AB) was used to take the measurement twice, repeated a 3rd time if the two measurements differed more than 1 centimeter. The mean of the 2 closest measurements was rounded up to the nearest integer.[185] The Height of Iliac Crest is a robust waist circumference testing protocol (Appendix 11),[209] with an MID limit of 5% change.[208]

The **Patient-Specific Functional Scale (PSFS)** is a patient-reported metric of function in musculoskeletal and work rehabilitation originally introduced 2 decades ago (ICF-10 Ac, P).[210] The participant choses 3-4 items where they lack in function and rate their level of functional difficulty on these tasks on a scale of 0 (unable) to 10 (able). The PSFS is robust for a wide

variety of MSD (including work claimants)[211-214] with a change between 2-3 points (pts) for appropriate MID limits for an average of 3 items.[211] Because of that range, the present study used an MID of 2.5 pts. Since the RtD participants responded to 3 or 4 items, the score was transformed in percentage with an MID limit of 25%. This metric can be found in Appendix 12.

This study used questions 1 and 2 of the **Work Ability index (WAI)**, a robust patient-reported questionnaire where the participant answers with a scale of 0-10 (0 being completely unable to work and 10 being fully able to work).[215] Question 2 contains a physical and mental subset and is weighted 0.5 pts twice (for a total of 1 point); the abridged WAI results in a maximal achievable of 20 pts (ICF-10 P). An MID on an abridged WAI could not be found; therefore a consensus was made for a change in 30% (6 pts on WAI) in any direction. Intuitive consensus on MID have been used in physical rehabilitation,[216, 217] this metric can be found in Appendix 13.

The **Patient Health Questionnaire-9 items (PHQ-9)** is a robust patient-reported questionnaire consisting of 10 items corresponding to daily presence of symptoms of depression. The first 9 questions are scored 0-3 pts (0 not at all, 1 several days, 2 more than half the days and 3 nearly every day) over the last 2 weeks, providing a 0-27 point severity score (ICF-10 B). Question 10 has no scoring. The PHQ-9 has been used with SM (including in the CAF),[121, 218-220] and has MID limit of + 5 pts or – 5 pts.[221] A CAF psychologist scored the PHQ-9. This metric can be found in Appendix 14.

2.4.3 Global Health Questionnaires

The **Short Form-36 questions version 2™ (SF-36v2™)** is a robust patient-reported questionnaire, in which the participants report their health related quality of life over the last 4 weeks using a physical and mental component summary.[222] A higher score is indicative of better health function, a lower score greater disability. This study analyzed the SF-36v2™ using a meaningful improvement in scores of +1.6 and +4.5 respectively for the physical and mental components summary for 6 months post-rehabilitation (ICF-10 B, Ac, P).[223] A research assistant scored the SF-36v2™, and license to use was purchased by 1 of the investigators (JH). This tool can be found in Appendix 15.

The **Outcome Questionnaire® 45.2 (OQ® 45.2)** is a patient-reported questionnaire with 45 items, using a 5-pts scale (4 never, 3 rarely, 2 sometimes, 1 frequently and 0 always). The OQ®

45.2 is a robust screening assessment for MHD symptoms such as distress, interpersonal relations and social role performance such as problems at work (ICF-10 B).[224] Higher scores are indicative of greater symptoms and therefore poorer mental health. Clinically meaningful change of this metric is suggested as a change in any of the following: 1) 14 pts in either direction, or 2) improvement noted by a decrease from ≥64 pts to 63 pts or below.[225, 226] The OQ® 45.2 was scored by a CAF psychologist, and license to use was funded by the psychologist's department. This tool can be found in Appendix 16.

Finally, use of mental health and physical rehabilitation services was extracted from the Canadian Forces Health Information System and appointment scheduling systems (as performed by other studies relating to MHD in the CAF).[227] Number of health care visits has been shown to be a robust predictor of recovery outcome in low back pain patients entering rehabilitation intervention.[119]

3. Analysis

3.1 Descriptive Statistics

This study used the most rigorous published MBD guidelines for analyzing data.[145, 155, 157, 228] To describe the baseline, this study used the Mean (M) as a measure of central tendency, and the Standard Deviation (SD) with the range as a measure of variability. These are adequate under circumstances where there are no outliers visually detected.[145] Limitations of the M and SD are that they are highly affected by outliers. In this study, the authors did not see many outliers in the repeated measures; therefore the M and SD were deemed acceptable.

3.2 Visual Analysis

This study used the most rigorous published MBD standards for performing visual inspection.[145, 155-157] Measures were plotted with simple line graphs[157] with upper and lower MID limits.[229] The used MID were: Minimum Detectable Change for the 4SST; Minimal Clinically Important Difference for the 5TSST, handgrip, waist circumference, PHQ-9; and clinical/operational change for body fat, PSFS and WAI. Limits are traditionally 2SD or 3SD bands[230-232] however those are based on a statistical approximation of a normal distribution, rather than on actual meaningful clinical changes. Since this study involved heterogeneity of participants, meaningful clinical changes were more appropriate than statistical techniques.

The visual analysis of repeated measurements was performed by systematically comparing adjacent phases,[156] according to the criteria defined in Chapter 15 (Table 2). As suggested by Bloom and colleagues,[145] a notation was assigned for improvement (+); no change/ambiguity (0); and for deterioration (–). On each graph, when the data points in the maintenance phase were outside the MID limits, (+) was given for improvement, or (–) was given in the case of a deterioration. Conversely, if the data points were not outside MID limit, the notation was (0) for no change/ambiguous. For dropouts, the last data points in the intervention phase were compared to the MID limits. In the case where an MID resulted outside the possible score of a measure, the maximal/minimal possible score was used as reference point for the notation. For each participant, (+) and (-) notations were summed for the repeated measurement in a synthesis table. The graphs were built with Microsoft Excel for Mac 2011 (Microsoft Corporation, Redmond, WA).[233-236] Statistical significance testing was not possible due to the high heterogeneity in diagnosis in the study sample.

4. Results

4.1 Sample

Three cohorts of participants were recruited for the study. Figure 6 shows the flow diagram of participants.[155] Of the 34 referred participants to the intervention, 23 met the inclusion criteria and were enrolled. The most common reason to be excluded was imminent release due to career-limiting MEL (n=5). Repeated measurements were obtained on all 23 participants for baseline and at least one data point in the intervention phase, and 16 (69.6%) completed the final testing post-intervention (final repeated measures and global health measurements).

Table 4 summarizes the participant characteristics. The proportion of males and females were similar at respectfully 11 (47.8%) and 12 (52.2%). Eleven participants (47.8%) had less than 9 years in their CAF service. Twenty-two (95.7%) were non-commissioned, and 22 (95.7%) from the regular force. The most prevalent diagnosis was lower extremity MSD, present in 6 participants (26.1%), followed by MHD (3 participants, 13.0%). Eight participants (34.8%) had between 1-2 secondary diagnoses and 8 participants (34.8%) had ≥5 secondary diagnoses.

In total, 7 (30.4%) participants dropped out. Amongst those, 1 (14.2%) returned to duty (confirmed), 1 (14.2%) did not return to duty and 5 (71.4%) are expected to return to duty (unconfirmed). No differences were noted between the dropouts and compliant participants. The attendance rate for the RtD sessions (independent and supervised) was acceptable

(M=80%). During RtD, 2 participants did not perform the lower extremity tests due to mild soreness induced by the RtD, but other measures were performed.

Figure 6: Flow diagram

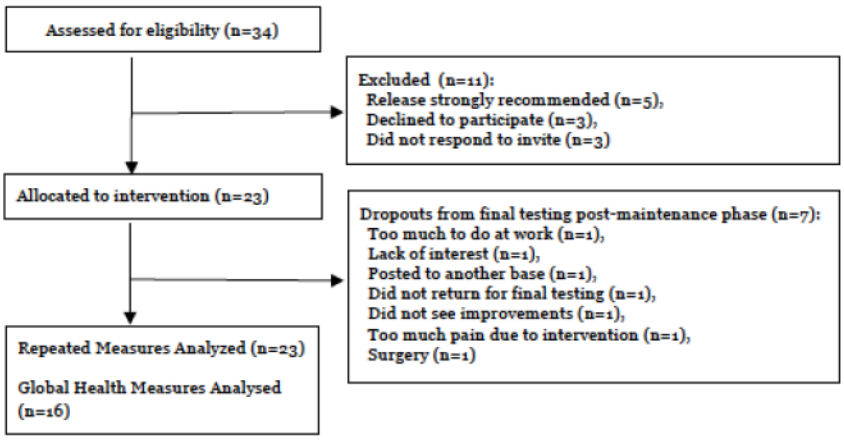


Figure 6: The flow of recruitment for the study. From the excluded groups, 5 had a release strongly recommended, meaning that they did not meet inclusion criteria due to their high likelihood of medical release (anticipated by the treating physician or nurse practitioner in the Canadian Armed Forces).

Table 4: Characteristics of study participants (n=23)

Characteristics	n=23	%
Gender		
Men	11	47.8
Women	12	52.2
Age, years (M=41, SD±8.3, range 26-51)		
16-26	2	8.7
27-37	5	21.7
38-60	16	69.6
Consecutive years in Canadian Armed Forces (M=13, SD±8.5, range 4-33)		
1-9	11	47.8
10-19	6	26.1
≥20	6	26.1

Rank		
Non-commissioned	22	95.7
Commissioned	1	4.3
Force		
Regular	22	95.7
Reserve	1	4.3
Posting		
3rd Canadian Division Support Base Edmonton	15	65.2
4 Wing Cold Lake	8	34.8
Primary diagnosis		
Lower Extremity Musculoskeletal Disorders	6	26.1
Upper Extremity Musculoskeletal Disorders	2	8.7
Spine Musculoskeletal Disorders	1	4.3
Mental Health Disorders	3	13.0
Traumatic Brain injury	2	8.7
Fibromyalgia	2	8.7
Cancer Survivor	2	8.7
Metabolic	2	8.7
Other (neurologic, syncope)	3	13.0
Number of secondary diagnosis (Range 0-10)		
0	1	4.3
1-2	8	34.8
3-4	6	26.1
≥5	8	34.8

4.2 Synthesis

The graphed results of repeated measurements for each participant (on which the visual analysis is based) can be found in Appendices 17-39. Table 5 represents the synthesis of the individual analysis for all participants, in descending order from favorable, to expected favorable, to unfavorable outcome. All cases are presented on the left side, followed by the repeated measures with their final notation (+, 0, -) for each measurement. The sum of all notations (+) and (–) for repeated measurements is shown in the next column for a general appreciation of the effect of the intervention on the function of the participants. This is followed by the pre and post values and change notation for the 2 global health questionnaires (SF-36v2™ physical and mental, as well as the OQ® 45.2). In addition, Table 5 shows primary diagnosis, compliance rate, FORCE evaluation results and primary outcomes pre and post in relation with the minimal standard for the participant's CAF occupation.

4.3 Primary Outcome

As depicted in Figure 7 this study found a confirmed return to duty rate of 39.1% at 6 months post-RtD. This rate includes 2 participants that had a CAF return to duty decision implemented during the intervention. All the participants that returned to duty did so in their current CAF occupation. In addition, 34.8% of the participants were expected to have a favorable outcome; that is, the physician recommended a G/O/A factor that would meet the threshold required for their occupation, but they were waiting on a official administrative confirmation in the CAF system. This means that overall, 73.9% of the participants had or were expecting a favorable outcome. The total number of participants expecting an unfavorable outcome was 13%; in addition 8.7% were medically released at the 6 months post-RtD and 1 took their voluntary release 9 weeks into the RtD (totaling 26% with an unfavorable outcome).

Figure 7: Return to duty at 6 months post-intervention (n=23)

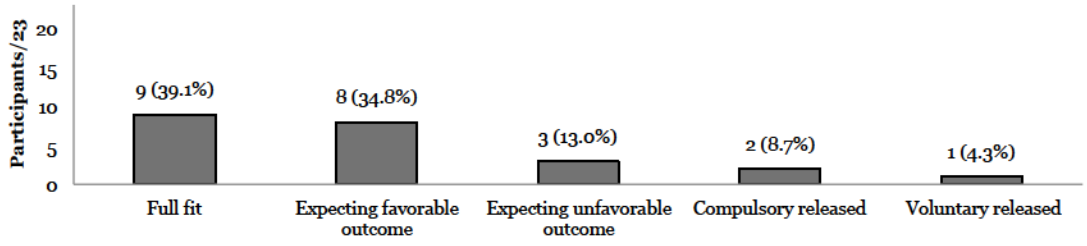


Figure 7: The return to duty rate 6 months post-intervention for all 3 cohorts, note the total favorable outcome group totaling 73.9%.

Table 5: Synthesis of participant results (n=23)

	Repeated measures									Global health questionnaires						Primary outcome			
Case	4 Squares Step Test	5 Times Sit to Stand Test	Body Fat	Handgrip	Patient Health Questionanire-9 items	Patient Specific Functional Scale	Work Ability Index	Waist Circumference	Notation for repeated measures (sum of + and - notations)	Short Form-36 questions version 2™ Physical component summary: pre, post	Short Form-36 questions version 2™ Mental component summary: pre, post	Outcome Questionaire®45.2: pre, post	Primary diagnosis category	Compliance rate	FORCE evaluation	Medical category pre-intervention	Medical category 6 months post	Threshold required for CAF occupation	Return to duty status
18	+	+	o	o	o	+	o	o	+++	48, 49 o	61, 60 o	40, 32 o	Upper extremity musculoskeletal disorder	78.4%	P	G5T6 O5T6	G2 O2	G2 O2	Full fit 9 weeks into the RtD
3	+	o	o	-	o	+	o	o	+-+	51, 57 +	50, 51 o	69, 73 o	Cancer survivor	51.7%	P	G3 O2 Much MEL	G3 O2	G2 O2	Full fit 9 weeks into the RtD
9	+	o	o	o	o	o	+	o	++	37, 36 o	38, 33 o	92, 89 o	Traumatic brain injury	100%	P	G4T6 O4T6 A5T6	G2 O2 A1	G2 O2 A1	Full fit 6 weeks post-RtD
10	+	o	o	o	o	o	+	o	++	34, 50 +	43, 54 +	74, 66 o	Fibromyalgia	95%	P	G4T6 O4T6	G2 O2	G3 O2	Full fit 11 weeks post-RtD
2	+	o	o	o	o	o	o	o	+	49, X	43, X	51, X	Traumatic brain injury	40%	P	G4T6 O3T6	G2 O2	G2 O2	Full fit 1 week post-RtD

19	+	o	o	o	o	+	o	o	++	40, 52 +	56, 61 +	36, 17 +	Lower extremity musculoskeletal disorder	75%	P	G4T6 O3T6	G2 O2	G2 O2	Full fit 10 weeks post-RtD
15	+	+	o	-	o	o	+	o	++-+	59, 60 o	46, 44 o	45, 47 o	Other (neurologic, syncope)	96.7%	P	G3 O3 Much MEL	G3 O3	G3 O2	Full fit 6 months post-RtD
23	+	+	o	+	+	+	+	o	++++++	31, 54 +	33, 46 +	70, 51 +	Other (neurologic, syncope)	100%	P	G5T6 O4T6	G2 O2	G2 O3	PCAT not breaching the U of S 6 weeks post-RtD
20	+	o	o	-	o	o	+	o	+-+	57, 54 o	63, 64 o	8, 4 o	Other (neurologic, syncope)	75%	P	G5T6 O4T6	G2 O3	G3 O3	Full fit 5 months post-RtD
5	o	o	o	o	o	o	o	o	o	37, X	56, X	55, X	Lower extremity musculoskeletal disorder	43.4%	X	G4T6 O4T6 A5T6	G3T6 O4T6	G2 O2	Category lowered 5 weeks post-RtD awaiting surgery
21	+	o	+	+	+	o	+	o	+++++	54, X	62, X	16, X	Lower extremity musculoskeletal disorder	40%	P	G5T6 O3T6	G? O2	G2 O2	Left for training 4 weeks into RtD, G3 O2 recommended, awaiting 6 months post-RtD
11	o	o	o	+	o	o	+	o	++	44, 61 +	56, 50 o	46, 36 o	Cancer survivor	100%	P	G4T6 O4T6	G? O?	G3 O3	G2 O2 Recommended
6	+	o	o	o	o	o	o	o	+	50, 53 +	45, 36 o	47, 57 o	Lower extremity musculoskeletal disorder	85%	P	G4T6 O3T6	G(?) O2	G3 O3	G3 Recommended 1 week post-RtD
17	o	o	o	o	+	o	o	o	+	27, X	56, X	39, X	Lower extremity musculoskeletal disorder	20%	X	G5T6 O3T6	G5T6 O3T6	G3 O2	Dropped out at week 4 of RtD, extension approved 2 months post-RtD

22	o	o	o	+	o	o	o	o	+	37, 41 +	52, 54 o	51, 51 o	Spine musculoskeletal disorder	90%	P	G4T6 O3T6	G? O?	G2 O2	Extension recommended 3 months post-RtD
12	+	o	o	o	o	o	o	o	+	50, X	43, X	68, X	Fibromyalgia	0%	X	G4 O4	G? O?	G3 O3	Dropped out during baseline, awaiting decision
16	o	o	+	-	+	+	+	o	+-+++	39, 49 +	42, 64 +	67, 8 +	Mental health disorder	76.7%	P	G5 O4	G5 O4T6	G3 O3	Status pending, medical category pre-RtD recommended only
1	+	o	o	+	o	o	o	+	+++	59, X	51, X	31, X	Metabolic	60%	X	G5 O4T6	G5 O4T6	G3 O2	Likely breach U of S, PCAT recommended
4	+	o	o	o	o	o	o	+	++	34, 34 o	56, 55 o	69, 62 +	Lower extremity musculoskeletal disorder	71.7%	P	G4T6 O4T6	G4T6 O4T6	G2 O2	Likely PCAT due to chronicity
14	+	o	o	+	+	o	o	+	++++	56, 59 +	17, 16 o	93, 126 -	Mental health disorder	79.4%	P	G5 O5	G5 O5	G3 G3	Likely to breach U of S Awaiting PCAT
13	+	o	o	o	o	+	o	o	++	33, X	49, X	55, X	Upper extremity musculoskeletal disorder	30%	X	G4T6 O4T6	G5 O4	G3 O3	Dropped out at week 7 of the RtD Breached U of S Transition out
8	o	o	+	o	o	o	o	o	+	48, 48 o	51, 42 o	54, 44 o	Mental health disorder	70%	X	G5 O4	G4 O4	G2 O2	Breached U of S Released
7	+	o	+	-	o	o	o	o	++-	50, 44 o	54, 43 o	65, 81 -	Metabolic	90%	X	G4 with MEL	G4 O3	G2 O2	Increase in MEL 9 weeks into the RtD Voluntary release during the RtD

Legend

Light gray: confirmed favorable outcome, medium gray: expected favorable outcome, dark gray: confirmed or expected unfavorable outcome

(+): Meaningful improvement; (-): deterioration, (o): no change/ambiguous, FORCE: Fitness for Operational Requirement of CAF Employment, MEL: Medical Employment Limitations, CAF: Canadian Armed Forces, G: Geographic factor, O: Occupational factor, A: Air factor, U of S: Universality of Service, PCAT: Permanent Medical Category, RtD: Return to Duty intervention, X=Participant did not perform final testing due to attrition, P=Passed, T=Temporary

4.4 Secondary Outcomes

Figure 8 depicts the meaningful changes in measures for the whole group. For the repeated measures, 16/23 (69.6%) participants demonstrated a meaningful improvement in the 4SST. Between 7-8 (30.4%-34.8%) participants showed a meaningful improvement in the WAI and PSFS respectively (both measures relating to recovery expectation). Deterioration was found in PHQ-9 (1/23, 4.3%) and handgrip (5/23, 21.7%). The majority of the results for repeated measures remained unchanged (notation "0").

For the global health questionnaires, 7/23 (30.4%) participants did not perform their retest post-RtD, hence the total number of respondents is n=16. Patent-reported physical health was measured by the SF-36™ physical component. Table 5 shows that at baseline (pre-intervention), 14/23 (60.9%) participants were under the 95% confidence interval on the SF-36™ physical component summary (normative values for Canadians M=50.5 pts, SD±9.0 pts, 95% confidence interval 50.3-50.7 pts),[237] indicating poor general physical health. Post-intervention, there was meaningful improvement in 9/16 (56.3%) participants.

Considering the mental health measures, Table 5 shows 11/23 participants (47.8%) pre-intervention below the SF-36v2™ mental component normative values for Canadians (M=51.7 pts, SD±9.1 pts, 95% confidence interval 51.5-51.9 pts).[237] With this measure, 4/16 (25%) participants meaningfully improved (Figure 8). For the OQ® 45.2, 9/23 participants (39.1%) were ≥64 pts of mental health cut-off at baseline (Table 5). In total, Figure 8 shows 4/16 participants (25.0%) that meaningfully improved. Figure 8 shows that the majority of participants showed no change in the mental health measures, although 2/16 participants (12.5%) showed deterioration in the OQ® 45.2.

To examine for possible differences between participants with favorable and non-favorable outcomes, the groups with confirmed return to duty and those expecting a favorable outcome were combined and compared to participants with confirmed release and those expecting unfavorable outcome. The data on changes in variables for these two groups was plotted on two graphs for visual comparison in Figure 9.

Figure 8: Results on measurement for whole group

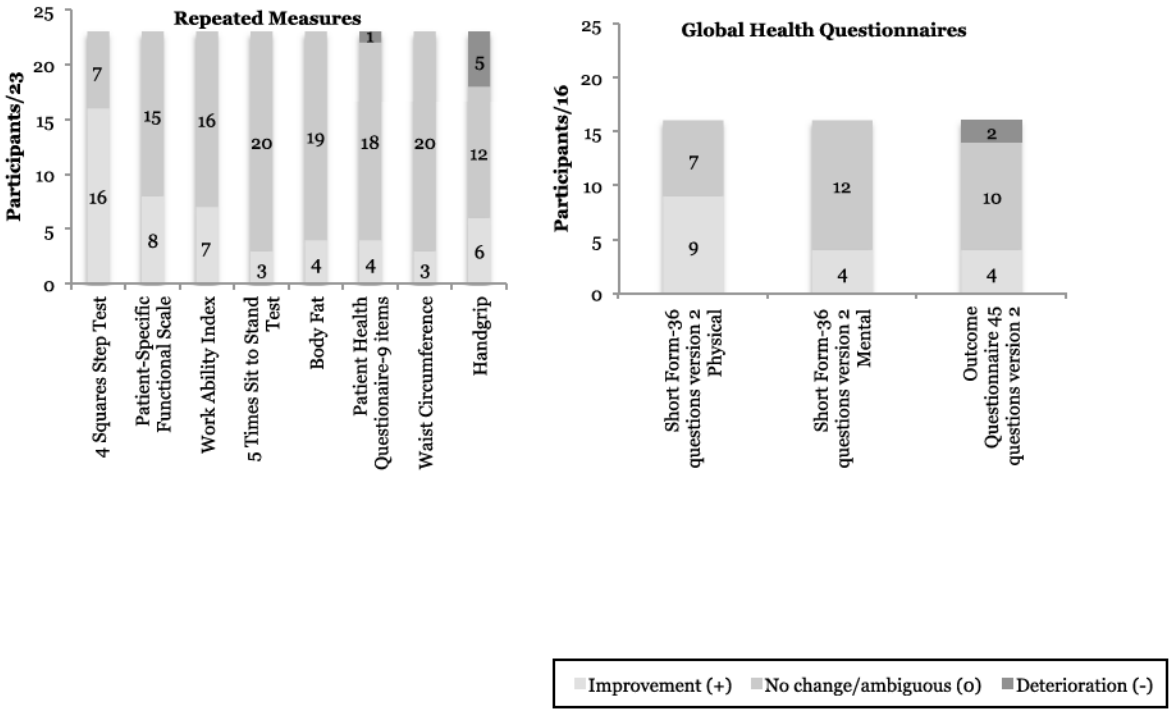


Figure 8: The results for repeated measures and global health measures for the entire group, indiscriminative of return to duty. Seven dropouts resulted in n=16 for the global heath questionnaires.

For the repeated measures, in the favorable group 12/17 participants (70.6%) showed a meaningful improvement in the 4SST, similar to the improvement in 4/6 participants (66.7%) in the unfavorable group in the 4SST. For the WAI, 8/17 participants (47.1%) in the favorable group had meaningful improvement, but no participants in the unfavorable group improved in the WAI. Deterioration was noted in handgrip for 4/17 participants (23.5%) in the favorable group, and for 1/6 participants (16.7%) the unfavorable group. Deterioration was also noted in PHQ-9 for 1/6 participants (16.7%) in the unfavorable group. In both groups, the majority of the data did not change meaningfully.

Figure 9: Results on measurement for favorable and unfavorable outcome

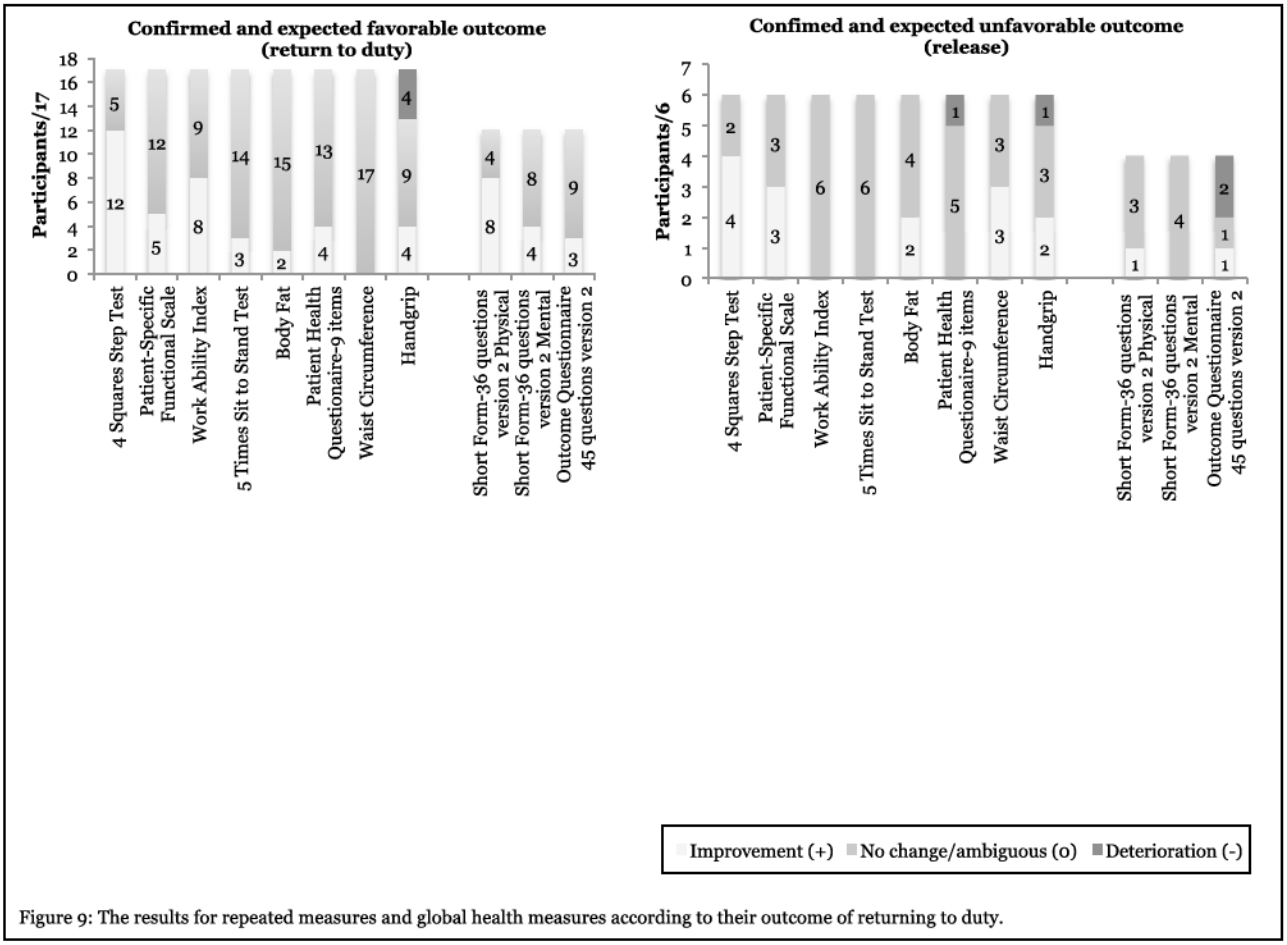
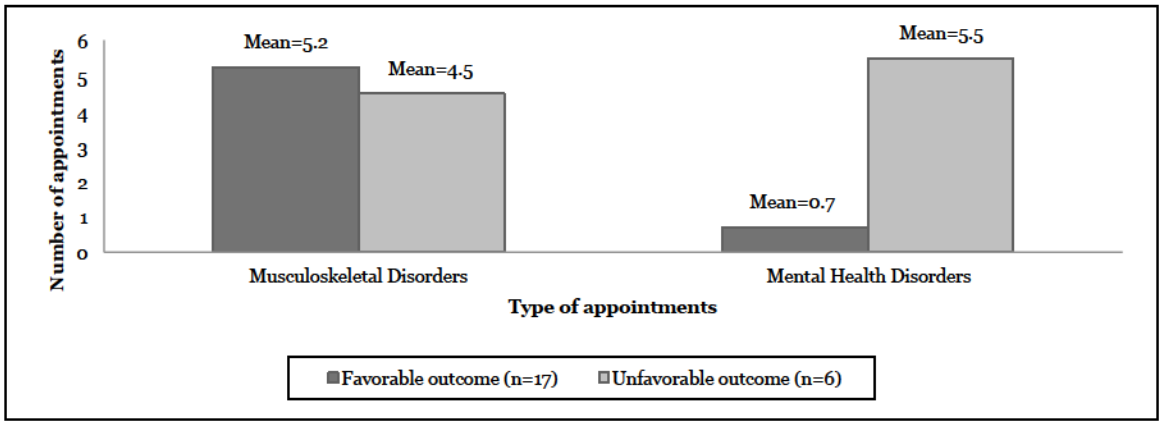


Figure 9: The results for repeated measures and global health measures according to their outcome of returning to duty.

Considering the global health measures, 8/12 participants (66.7%) in the favorable group showed meaningful improvement in the SF-36v2™ physical component, 4/12 participants (33.3%) showed improvement in the SF-36v2™ mental component, and 3/12 participants (25.0%) improved on the OQ® 45.2. The remainder of participants in the favorable group had no meaningful change. In the unfavorable group, only 1/6 participants (16.75%) showed improvement in the SF-36v2™ physical component, none improved on the SF-36v2™ mental component, and 2/4 participants (50%) deteriorated on the OQ® 45.2.

Table 6 depicts the use of mental health and physical rehabilitation services for both MSD and MHD. The group with favorable outcome had approximately 6 times less MHD appointments.

Table 6: Use of mental health and physical rehabilitation services for participants during intervention



5. Interpretation

5.1 Returning to Duty

The current study aimed at determining if participants in the RtD would return to duty in the CAF 6 months post-intervention; and if meaningful changes in physical, health and mental function would occur during and post-RtD, compared to the participant's baseline. To the author's knowledge, this is the first published evidence on a return to duty intervention in the CAF. The confirmed return to duty rate of 39.1% is a strong improvement from the current CAF unpublished national return to duty rate of approximately 20%-30% at the time of writing.[238] Considering those with an expected favorable outcome, 73.9% of the participants at 6 months post-RtD were expected to return to duty, which is superior than the highest return to duty rate on any CAF base/wing at the time of writing (approximately 60%, unpublished).[238] The return to duty rate found is similar to other armed forces. Booth-Kewley and colleagues[28] reported that amongst a sample of 166 male U.S. Marines with MSD, the return to duty rate was 54.2% (n=90). In the present study, 25.9% of the sample had an unfavorable outcome (release or anticipated release), which is similar to previous research in the CAF reporting a rate of release between 8%-21.3%.[160, 227] The comparison with these return to duty/release rates must be contextualized, as these publications present with many differences in type of intervention, participant selection, location, etiology of disability, deployment status, and presence of MHD.

For this study, several factors related to the design may have influenced the high return to duty rate reported. Returning to duty can have a strong social significance for the SM,[147] which could have positively influenced the outcomes where the majority of the participants were likely to return to duty. The use of a heterogeneous population where the commonality may have been

the desire to return to duty (rather than a common diagnosis) simulated SM rehabilitating together despite varying levels of ability and skill. The RtD was provided in a group setting for a total of 25 hours over 10 weeks. This provided socialization for the participant and could have been a mediator of returning to duty, since current rehabilitation in the CAF can be isolating.[99] Socialization, motivation, cohesion and *Esprit de Corps* has been identified as a component of successful military training and return to duty.[28, 110, 239] For example, a study demonstrated that 95% of U.S. soldiers would return to duty if treated in a combat support unit, thereby remaining close to their unit.[20]

Selection of participants may have also resulted in a positive outcome for the majority of the group. In particular, the exclusion of referrals with an expected imminent release likely shifted the sample towards a greater likelihood of positive outcome. However, given the consideration of allocation of scarce resources, it may be advantageous for participant selection to be biased towards those with the greatest likelihood of returning as a productive CAF member. The high return to duty rate, in light of the specific referral process and inclusion criteria, should be of interest to CAF policy makers, and could positively affect the productivity in units. At any given day in the CAF, approximately 1.4% of the CAF is on excused duty (1.2% for males and 2.9% for females), totaling approximately 250,000 sick leave days costing approximately $102 million yearly to the CAF.[240] Policy makers should also consider the indirect cost of disability in the armed forces. In the U.S., the replacement of non-deployable SM due to MSD for a deployable healthy soldier requires 11 hours of substitution.[120] It is thought that programs such as the RtD may assist with the high burden of morbidity to lessen the impact on CAF operations, with minimal additional costs. Given the in-house design, the additional requirement was minimal: almost no additional resources were required for identification of participants and for the intervention itself. Should RtD face a national rollout in the CAF, incremental costs could be primarily staffing across bases/wings based on number of referrals.

In the CAF, regular force service is 20 years long. In this study, 11 participants (47.8%) had less than 10 years in their CAF service despite being older (69.6% aged 38-60), and 95.7% were non-commissioned. These factors may represent an incentive to be retained since there is a benefit cut-off if released after 10 years of service in the CAF.

5.2 Repeated Measures

Although generally the repeated measures may have not discriminated between those that returned to duty or not, Figure 8 showed that some measures seemed to have improved in participants more than others. The 4SST improved in 16/23 participants (69.6%). This was expected given that 26.1% of participants in this study had a lower extremity MSD as the primary diagnosis, and many of the physical exercises focused on lower extremity function. The SF-36v2™ physical component also improved in a significant number of participants overall (9/16, 56.3%).

The PSFS showed meaningful improvement in 5/17 participants (29.4%), and the WAI improved in 8/17 participants (47.1%), all in the favorable group (Figure 9). These measures relate to recovery expectation. These results may be expected, knowing that Booth-Kewley and colleagues[241] found in 134 U.S. Marines with MSD that psychological factors (pain severity and fear-avoidance beliefs about work) were statistically significantly predictive of recovery one year after injury (recovery expectation being the strongest predictor). The authors concluded that patients with positive recovery expectation might use more effective coping strategies, hence reducing distress and negative emotions, which in turn may lower pain levels and lead to improved return to duty rate. In a different study, a similar research group[28] found that across a sample of 166 young male Marine recruits with MSD, positive recovery expectation was the strongest predictor of return to duty; recruits who believed they would graduate were 6 times more likely to return to duty than those who lacked such belief. This phenomenon is also seen in civilians. A systematic review on non-specific low back pain, performed by Iles and colleagues,[51] found 9 studies (including 4 high quality) supporting recovery expectation as a robust predictor of return to work. Gross and colleagues[116, 117] also suggested that work readiness and behavioral factors could be of primarily importance, over physical rehabilitation, in work claimants of various diagnoses.

As found in Figure 8, body fat (measured by skinfolds and waist circumference) did not show meaningful changes in the vast majority of participants. Studies have shown that skinfold thickness may be less sensitive than waist circumference (due to the lability in fat storage), can show a greater technical error of measurement (even on trained providers), and is not recommended for participants with a body mass index ≥30 kilograms/meter^2.[199, 242] Considering this, achieving a leanness target below a defined threshold could be more advisable than a change outside MID. Moreover, changes in body fat would yield mostly by improved nutrition

habits and not via physical activity,[243] and it is therefore possible that the nutritional part of the health and work literacy was ineffective, or taught too late within the 10 weeks.

The study did not show a high magnitude of depressive symptoms according to the PHQ-9 results. With this measure, a score between 10-19 indicates a range from uncomplicated mild-moderate depression, to a moderately severe major depression. A score of 20 indicates a severe, major depression. In this sample, 19/23 participants (82.6%) had a M score below 10 and 4/23 participants (17.4%) had a M score in the low 10-19, indicating the participants did not meet the criteria for depression. Despite the low magnitude of MHD in the 3 samples, 4/17 participants (23.5%) in the favorable group did improve meaningfully in this measure, and 1/6 participants (16.7%) deteriorated in the unfavorable group (Figure 9).

Overall, the majority of notation "0" shown in Figure 8 and 9 is not unexpected in a MBD context. In a small heterogeneous group study such as the RtD, it was important to collect multiple measures representative of multiple categories in order to determine what might be relevant to track in future studies. Hayes suggests that in SSD repeated measures "It is better to collect measures of medium quality than to collect none because excessively high standards of measurement are set."[244 (p 195)]

5.3 Global Health Questionnaire – Physical Health

Meaningful improvements in the SF-36v2™ physical component were found in 9/16 (56.3%) participants (Figure 8). In addition, 16 participants attempted the FORCE evaluation and 100% of those passed (Table 5). The improvements in physical health are consistent with the findings for the repeated measures, as the majority of meaningful improvements were in physical measures for both favorable and unfavorable outcome groups (Figure 9). Despite this, as seen in Table 5 there was no consistent association between MSD diagnosis and the improvements seen. This suggests that the overall fitness and exercise portion of the intervention was generally successful at improving physical health and function, unrelated to specific diagnoses.

5.4 Global Health Questionnaires - Mental Health

A moderately high rate of MHD was found at baseline. As depicted in Table 5, 9/23 of participants (39.1%) were above the OQ® 45.2 healthy cutoff at baseline, and 13/23 (56.5%) were under the SF-36v2™ mental component 95% confidence interval for Canadians.[226, 237] This is contrasted by the study not recording a high magnitude of MHD with the PHQ-9, although

this measure is strictly a measure of depressive symptoms, whereas the other global health measures consider a broader spectrum of MHD, such as interpersonal relations and social role performance. It is important to note that Table 5 also depicts differences in mental health for the favorable versus unfavorable groups. In the favorable group, the percentage of participants below the 95% confidence interval[237] on mental health for the SF-36™ pre-RtD was 9/17 (52.9%) and in this group, 4/12 participants (33.3%) meaningfully improved. In the unfavorable group, 4/6 participants (66.7%) were below the mental component confidence interval pre-RtD, and in this group none of the participants had a meaningful change.

Similar results were found in Table 5 for the OQ® 45.2. Pre-intervention, 6/17 of participants (35.3%) in the favorable group were ≥64 pts. In this group after dropouts, 3 meaningfully improved but 9 did not (Figure 9). From the unfavorable group, 3/7 (42.9%) participants were above cut-off, and in this group 1 improved and 1 deteriorated. Despite not having the same amount of participants pre and post-RtD for these measures, it could be suggested that the majority of the participants in the favorable group started with low MHD, but improved during the intervention, which could suggest improved MHD as a mediator of return to duty.

In this study, 2/3 participants with MHD as a primary diagnosis were in the unfavorable group. Previous literature examining soldiers with MHD indicates a relatively poor prognosis for return to duty. Neal and colleagues[50] followed 309 British soldiers released from in-patient, psychiatric military care who had been recommended as eligible for retention. Of those, 78 (25.2%) were operationally fit in the 0-6 months period, 54 (17.5%) at the 6-12 months period, 45 (14.6%) at the 12-18 months period and 67 (21.7%) at the 18-24 months period. The authors predicted the retention of British soldiers 2 years after release from military psychiatric care as 22%. In the current study, prediction of return to duty is impossible to infer, but the low return to duty rate in the ones with MHD could be due to a high magnitude of MHD/lack of meaningful improvement.

6.Exploratory Discussions

6.1 Model of Return to Duty

Despite many secondary measures receiving a notation "0", 34.6% of the study sample returned to duty, and a total of 74.1% were expecting a favorable outcome 6 months post-RtD, with 2 participants returning to duty during the intervention. The core concept of the MBD is measuring the impact of the change during the evaluation to improve the outcome.[157] For this

study, the inconsistencies in measures versus outcome raises the possibility that the CAF return to duty model may be ecological. In the ecological model of return to work following MSD, administrative decisions of outcomes are based on financial criteria, as opposed to meaningful clinical changes in the work claimants.[94, 245] Since the process of returning to duty in the CAF is based on principles of occupational medicine and administrative factors, this could explain some inconsistencies between the lack of change in the secondary measures and the actual return to duty decisions.

6.2 Ecological Interventions

The work environment can be an important factor of successful return to work in civilians. Environmental factors such as workplace modification and consultation with return to work stakeholders are important,[94] but were not primarily part of the RtD. Adapting environmental factors results in an intervention that is ecological, which might be superior at returning people to work since it takes into account the overall characteristics of the worker, the work environment and the interactions between them.[246] An ecological intervention including work adaptation and modification of the environment is challenging in the CAF, since conformity of the individual with the organization is critical for succeeding in missions. Another example of an adaptation for successful initiative is graded return to work.[30] In the CAF, graded doses of work may be challenging to prescribe due to the tempo requirement at the units. RtD was a total of 2.5 hours per week for 10 weeks, plus approximately 2 hours of non-supervised physical exercises, for a total of approximately 50 hours of rehabilitation. This is lower than the recommended dose of 100 hours for rehabilitation of low back pain.[96, 247] This is because the need for rapid and effective reconditioning is important to optimize productivity in military population.[110, 248]

6.3 Strengths

Generalization refers to the ability to infer study results from a sample to a population. In experimental designs, the MBD offers strong generalization when it is replicated with a minimum of 3 or more participants performing a minimum of 3 baseline measures.[120, 137, 145-147, 153, 155-157, 162, 167, 169, 228, 244, 249-252] In this study, only 2 participants had less than 3 measures in the baseline (due to their busy schedule), which is in favor of generalizability in the CAF. Furthermore, this study used direct, inter-subject replication of an identical, documented intervention across 23 participants over 2 different settings. Heterogeneity in diagnosis comprised in the selection of research participants is a strength. Sachs and colleagues[253]

compared functional restoration programs for spinal disorders and reported their program as less expensive and less time-consuming than other programs that had a narrower participant selection. Furthermore, experiential studies with the armed forces (such as the ones comprising heterogeneity in diagnosis) lies in the "real world applicability".[50 (p 340)] With a heterogeneous MHD group, Neal and colleagues[50] suggest that a military rehabilitation group can assess risk and reduce the imposition of unnecessary occupational restrictions in SM. The RtD was designed as a group treatment, independent of individual diagnoses and function levels. In the CAF, the SM also works in heterogeneous sections with varying levels of skill and duties.

Finally, considerable variation can be found in MID depending on the population studied, the intervention tested, and its context.[111, 229, 254] However, using MID was a strength due to relevancy (compared to statistical significance) given that heterogeneity was present, as it could increase variability, which in turn may mask the effect of the intervention.

6.4 Controllable Limitations

The high return to duty rate could be partially explained by this study's selection criteria, as the participants were screened to have the potential to return to duty (not expected to be imminently released), and were assumed to be compliant to medical appointments. The sample of the current study contained SM from the Canadian Army and the Royal Canadian Air Force. Further studies on CAF return to duty should examine a broader sample including the Royal Canadian Navy. Finally, this study did not control for prior deployment, which can lead to MHD which in turn, could negate return to duty.[160, 227] Among 30,513 CAF service personnel returning from Afghanistan, 1.2% were diagnosed with a service-related MHD not due to Afghanistan and 4.5% had a non-service related disorder.[227]

When a SM completes their rehabilitation, a period of stability is required as physiological and functional gains can still be fragile, therefore MEL might not be immediately removed in the CAF.[126] The study showed that 6 months for a follow up period was insufficient. The authors recommend a minimum of 12 months, particularly given that 2 medical categories of 6 months is often an administrative cut-off for chronicity in the CAF. Brown[99] described the rehabilitation in the CAF as long, frustrating, painful and filled with months/years of rehabilitation. Finally, the health and work literacy component may not be suited for all SM, especially when heterogeneity is large. As a civilian example, effectiveness of education for neck disorders remains unclear.[255]

As opposed to MID, target below a defined threshold could be another way to analyze all mediator variables in future studies. Of note, we may not know the threshold required to meet the occupational demands in the CAF for mediator variables. As a solution, studies could monitor which participants from a sample would meet all thresholds. Furthermore, superior techniques of methodology and analysis of SSD have been proposed such as procedural contrast, percentage of overlap, median level and relative level change.[156] This study contained non-identical continuous phases, resulting in difficulty applying those techniques. In addition, seldom anomalies were also found in this study's baseline, but Hayes argues that although a flat baseline is preferred, it is not a rigid rule.[244] Also, this MBD was non-response guided and unfortunately, type I error rate can be high with these designs.[162] For ethical purposes, a limit duration for the baseline had to be assigned to avoid delaying treatment. Generalization could be weakened by the fact that 2 participants had less than 3 data points measured at baseline.

The study used an arbitrary decision on the MID for the WAI which is simple, but can be problematic.[217] A different cut-off than 30% could have shown a different result in the favorable group. For example, a sensitivity analysis with using a 50% cut-off would change all notations of "+" to "0" in the results (excluding the ones that reached the maximal 20 pts). In other words, 8 participants (47.1%) in the favorable group improved with 30% MID on the WAI, but no participants would with a 50% MID. Despite the preposition of a 30% change in work-related function "as a general barometer of positive clinical change"[256 (p 322), 257], future studies using patient-reported metrics could use the rule of thumb of approximately 5-10% MID in quality of life instruments.[258]

6.5 Uncontrollable Limitations

Despite increasing the level of confidence in the study, repeated measures could adversely infiltrate testing effects leading to results solely attributable to learning effects.[145, 162, 259] For example, some participants could be improving on the 4SST simply by performing it twice a week for 4 weeks. Should SM present with a high level of deconditioning, their function may have increased in the multiple baseline simply by executing the repeated measures and becoming more proficient. This is concerning as data points could be related and therefore, autocorrelated. Bloom and colleagues[145] defines autocorrelation as observation/measurements being dependent on each other. The authors also suggest that 6 or fewer observations in the baseline could hide autocorrelation and therefore be serial dependent. This is concerning since serial dependency can result in an increase in type I and type II errors, respectively for positive

and negative autocorrelation.[157] The authors suggest that since sometimes autocorrelation in SSD cannot be visually detected, the suggested steps for when investigators suspect autocorrelation are to: 1) refrain from using statistical significance tests at all; and 2) perform cautious visual analysis. Hence, in this study, replacing statistical significance with rigorous visual analysis was sound. Another way to deal with possible autocorrelation is to transform the data to perform statistical significance. Wolery[260] suggest that transforming the data could reduce skewness and increase linearity/predictive validity in the data, the drawback being that the true value of that datum is lost, making it difficult for a 2nd rater to visually analyze the data (and for the reader to have clinical appreciation). Furthermore, many transformation tests requires approximately 15 data points before yielding confidence in the results.[145]

6.6 Future Directions

Early identification of appropriate participants may be a key for success in the retention of SM. In civilians with low back pain attempting return to work, a shorter time between injury and admission to a rehabilitation program was shown to predict time-loss benefits (a surrogate of return to work in this study).[117] Therefore a return to duty intervention should attempt to identify those with potential to benefit from the intervention as early as possible.

Substandard communication across stakeholders may also be detrimental to successful return to duty.[20] Improved rehabilitation models have been suggested, such as the system-supported practice by Stead.[48] This model focuses on the system performance, a team of staff, a well-defined process and tools for consistency. System-based practice produces simplification and standardization. Program centralization may also be an effective component of a return to duty model, since it positively provides to the SM' cognitive enhancement and oversight/support.[248] As a result of centralization, the staff can collect and disseminate best practice, develop funding requests for expensive equipment and conduct assessment that will be consistent amongst stakeholders.[248] For RtD, this could mean that all best practices could be shared nationally to improve the system, and to reduce the burden of staff making return to duty predictions based on beliefs or rote memory.

Loisel and colleagues[246] discussed the importance of social sciences in return to work and disability studies. In order to understand the complexity of return to duty in the CAF, further studies could use a clinical controlled trial using mixed method (with a minimum of 30

participants).[169] Such a method should also bring greater involvement in the process from the stakeholders.[261]

The limited amount of changes in the repeated measures may be an indicator of the need to find different mediators for the CAF. The PHQ-2 is a convenient variant of the core PHQ measures. This ultra-brief depression screen has 2 items scored 0-3 for a total score of 0-6. The Generalized Health Questionnaire-12 is a robust metric of psychological distress that has been used in military population[28] an could be a more practical way of evaluating MHD. A more feasable measure of adiposity may be considered: waist circumference alone may be better than skinfolds to provide information on adiposity[242] and the exact protocol for waist circumference may not have substantial influence on the results.[262] Individual measures (like spine dysfunction tests) may be suited for individual dysfunction; however, this is impractical in a heterogeneous group setting.

7. Conclusion

To the author's knowledge, this is the first published evidence on a return to duty intervention in the CAF. The study found a confirmed rate of return to duty of 39.1% and an expected rate of return to duty of 73.9%. Some meaningful changes were recorded such as global physical function and recovery expectation in the group that returned to duty. Amongst those changes, mental health may be a mediator of return to duty in the CAF. Participant selection and minimizing resource allocation to maximize effectiveness of a return to duty intervention are important factors to consider for policy makers. These positive findings may be useful for the Canadian Armed Forces in reducing the burden of morbidity and facilitating the return to duty process.

8. Acknowledgement

This intervention has received extensive in-kind support from a large list of CAF contributors in the form of conceptual, logistical and delivery support, to name a few: Canadian Forces Morale & Welfare Services, Personnel Support Program Edmonton/Cold Lake, 1 Field Ambulance and 22 Health Services Cold Lake, CAF Health Promotion Edmonton/Cold Lake.

9. Conflict of Interest

The research team (Appendix 40) has no competing interests or financial arrangements that would represent a conflict of interest for this research.

17. STUDY VALIDITY

The validity of a study is a trade off between internal and external validity (generalizability). This study addressed internal validity by reducing potential instrumentation threat. Instrumentation threat has been presented as a potential concern for systematic error in SSD,[114, 153, 155-157, 184] primarily due to the repeated measures. Table 7 presents the strategies used in this study to increase accuracy in measurements (decreasing instrumentation threat).

Table 7: Strategies to reduce instrumentation threat (adapted from Hulley)

Instrumentation accuracy	How strategies relates to current study
Standardizing the measurement methods in an operation manual	An operation manual was introduced to the staff prior to commencing, staff were given a minimum of 4 weeks for review and practice. Participants were tested always on the same day, time, location and resting conditions.
Training and certifying the tester	Staff received approximately 5 hours of training (theoretical and practical) endorsed by Canadian Society for Exercise Physiology prior to commencing.
Refining the instrument	Instruments were the highest quality available on the market; including digital display.
Automating the instruments	Instruments had microprocessor built-in for automated calculation.
Calibrating the instrument	Instruments were factory calibrated, brand new and only used for the study.
Blinding	Testing staff was blind to the meaning of the values (clinical meaningfulness). Participants were tested in isolated, individual settings.

This study also addressed external validity in an attempt to increase generalization. In SSD, strategies to increase the SSD external validity (generalizability) are performed with direct, clinical, and systematic replication.[145, 153, 156] In direct replication, the intervention is iterated with different participants but under identical conditions, creating a reliable treatment procedure. This study directly replicated the data collection at 3 different time points for 23 participants. Clinical replication follows direct replication or is simultaneous to systematic replication, as an advanced procedure in which related treatments procedures are applied to cohorts. In this study, the clinical application of 2 intervention components (physical training with health and work literacy) was conducted as a work-rehabilitation treatment. Systematic replication is performed in different settings and therapists (either singly or in combination) to evaluate if the intervention is effective. This study systematically replicated in 2 different settings (Canadian Army and Royal Canadian Air Force) with multiple staff. In this multisite

approach, all staff were trained identically and provided an identical intervention. Therefore, this study was able to reduce the potential threat in validity commonly seen in SSD.

18. STUDY SIGNIFICANCE

In order to analyze a SSD, Bloom and colleagues[145] suggests 3 types of significance: practical, theoretical, and statistical. Practical significance refers to a clinical comparison of functioning against a standard most commonly used. Although Rossi suggested that there is no all-purpose best way to appraise practical significance[129 (p 316)], this study related to a practical significance by having participants perform the FORCE evaluation.[133] The FORCE evaluation makes it a practical determinant of function in SM that are in the CAF, increasing the significance of the intervention and study. Theoretical significance is how to relate expected outcome with change in behavior and improvement in participants. This study used MID limits with the mediator variables[229] and since those were not based on actual meaningful changes in function, MID represent a high degree of interpretability in research participants, clinicians and policy makers.[217] The theoretical significance of this study is present due to the choice of MID limits that claim meaningful improvement or deterioration. Statistical significance is challenging, since the debate over SSD data meeting assumptions of parametric statistics is ongoing.[184] Satake and colleagues[250] suggested that proceeding with parametric method in SSD analysis is feasible despite violating some assumption. Bloom and colleagues[145] suggested that many statistical assumptions are difficult to test for SSD, and that violating them to a certain extent may not be seriously problematic. Nevertheless, since this study presented with a high level of heterogeneity in the presentation of participants, statistical significance testing was not performed.

19. STUDY RIGOR

Extraneous variables in experimental research (specifically in SSD) cannot be entirely eliminated from studies, at best it is feasible to minimize this influence.[145] Methodological qualities scales to evaluate rigor in SSD have been published. The Single Case Experimental Design was developed by Tate and colleagues,[149] the scale contains 11 items (only 10 items can be scored) with dichotomous responses (0 point=absent, 1 point=present). The authors published excellent reliability and sensitivity, with good level of inter-rater reliability for total score SSD studies pertaining to acquired brain impairment. Intra-class correlation was 0.83 for individual raters and 0.88 between pair of raters using consensus rating and novice rater following training. This study obtained a total score of 8/10 on self-appraisal (Table 8). Guidelines

published by Romeiser Logan and colleagues[263] contain 5 levels of evidence (I-V), depending on elaborate criteria (I being the highest level of evidence). In addition, 14 questions based on quality of group design create a cut-off of strong, moderate or weak SSD. The answers are dichotomous and a "yes" indicates 1 point (except questions 5 and 8 are in two parts therefore 0.5 point to each part), the authors published an inter-rater agreement at 75%. This study obtained a total score of 9/14 on self-appraisal, and a level III evidence (Table 8). In addition, Horner[147] published quality indicators for SSD, but this list is not a numerical system. Of note, Kratochwill[154] argue that there an be exception to those standards (including having 2 raters) and that this decision if left to the investigator knowledge and the outcome variable as long as a reason is specified. The self-appraisal of rigor can found in Table 8.

Table 8: Self-appraisal of rigor (adapted from Tate, Romeiser Logan and Horner)

Single-Case Experimental Design scale	Current study	Romeiser Logan scale	Current study	Level of evidence	Quality indicators	Current study
Scores the quality of methodology		Scores the quality of reporting		Scores the quality of methodology	Scores the quality of reporting	
1. Clinical history (does not contribute to score)	Present	1. Description of participants and settings?	Yes 1 point	Non-randomized, non-concurrent, controlled MBD, clear-cut results, generalizable and limited causal inferences.	Participants described with enough detail?	Description make replication possible
2. Target behavior	Present 1 point	2. Independent variables operationally defined?	Yes 1 point		Selection process precisely replicable?	Enough information is provided
3. Design	Present 1 point	3. Intervention conditions operationally defined?	Yes 1 point		Physical setting description?	Enough for replication
4. Baseline	Present 1 point	4. Dependent variables operationally defined?	Yes 1 point		Dependent variable described?	Operationally described for replication
5. Sampling behavior during treatment	Present 1 point	5. Interrater or intrarater assessed before and during each phases	Yes for intrarater 0.5 point		Dependent variable measurable?	Quantifiable
6. Raw data record	Present 1 point	6. Outcome assessor unaware of the phase of the study?	No 0 point		Dependent variable valid?	With specific index to replicate
7. Inter-rater reliability	Absent 0 point	7. Stability of data demonstrated in baseline?	Yes 1 point		Interrobserver agreement on measures	Absent
8. Independence of assessors	Present 1 point	8. Type of SSD clearly stated?	Yes 0.5 point		Independent variable described?	Enough for replication
9. Statistical analysis	Absent 0 point	9. Five data point in each phase?	No 0 points		Independent variable systematically	Static

					manipulated and controlled?	
10. Replication	Present 1 point	10. Effect of intervention replicated across 3 or more participants?	Yes 1 point		Fidelity of implementation for independent variable?	Overt
11. Generalization	Present 1 point	11. Conducted and reported appropriate visual analysis?	Yes 1 point		Baseline present?	Yes
		12. Graph for visual analysis followed standard conventions?	Yes 1 point		Baseline replicable?	Yes
		13. Statistical analysis performed?	No 0 point		3 data points effect at 3 separate measures?	Only for 14 participants
		14. All criteria met for statistical analysis?	No 0 points		Controls for threats for internal validity?	Instrumentation, co-intervention (treatments, physical activity)
Total score for current study = 8/10 points		Total score for current study = 9/14 points		Level III evidence	Experimental effects replicated?	Across settings and participants
					Dependent variable socially important?	Important to remain employed in armed forces
					Magnitude of change in dependent variable socially important?	Factors relates to threshold of retention at a given occupation
					Independent variable implementable?	Intervention did not requires supplementary costs
					Social validity in independent variable?	Intervention has implication in policy making and productivity
					Pattern demonstrating experimental control?	Present

20. SUMMARY

It is known that life in the armed forces is rigorous, and that it can lead to mental and physical disorders. As a result, there is a large amount of SM that are medically released from the armed forces annually. This brings a huge financial cost and a burden for retraining SM, leading to reduced productivity in the armed forces. In the CAF, this study found a confirmed return to duty rate of 39.1% and a prospective favorable rate of 73.9% (n=23) with the RtD intervention. Due to many contextual differences, the return to duty rate found cannot be compared to the

actual rate nationally for the CAF (anecdotal/unpublished). Despite this, this study is a first step towards larger studies that could investigate treatment models for return to duty in the CAF. A large amount of work needs to be initiated to understand if the return to duty rate in the CAF can be increased when treatment is provided on a homogeneous versus heterogeneous group, and to find out which mediators can predict retention. It is possible that if SM attempting return to duty (and being enrolled in an intervention) meet all predetermined mediator thresholds, predictors will be found. The overall implications of increasing the return to duty rate is beneficial for the policy makers and clinicians however, retention may be even more meaningful for the proud members of the CAF.

BIBLIOGRAPHY

1. Goffar SL, Reber RJ, Christiansen BC, Miller RB, Naylor JA, Rodriguez BM, et al. Changes in dynamic plantar pressure during loaded gait. Phys Ther. 2013;93(9):1175-84.
2. Knapik JJ, East WB. History of United States Army physical fitness and physical readiness training. US Army Med Dep J. 2014:5-19.
3. Hauret KG, Bedno S, Loringer K, Kao T-C, Mallon T, Jones BH. Epidemiology of Exercise- and Sports-Related Injuries in a Population of Young, Physically Active Adults: A Survey of Military Servicemembers. The American Journal Of Sports Medicine. 2015;43(11):2645-53.
4. Vaara JP, Kalliomaa R, Hynninen P, Kyröläinen H. Physical Fitness and Hormonal Profile During an 11-Week Paratroop Training Period. The Journal of Strength & Conditioning Research. 2015;29:S163-S7.
5. Scherer Mr, Weightman MM, Radomski MV, Davidson LF, McCulloch KL. Returning Service Members to Duty Following Mild Traumatic Brain Injury: Exploring the Use of Dual-Task and Multitask Assessment Methods. Physical Therapy. 2013;93(9):1254-67.
6. Zambraski EJ, Yancosek KE. Prevention and rehabilitation of musculoskeletal injuries during military operations and training. Journal Of Strength And Conditioning Research / National Strength & Conditioning Association. 2012;26 Suppl 2:S101-S6.
7. Szivak TK, Kraemer WJ. Physiological Readiness and Resilience: Pillars of Military Preparedness. The Journal of Strength & Conditioning Research. 2015;29:S34-S9.
8. Caravalho JJ. Improving Soldier Health and Performance by Moving Army Medicine Toward a System for Health. The Journal of Strength & Conditioning Research. 2015;29:S4-S9.
9. Morgan ICA, Cho T, Hazlett G, Coric V, Morgan J. The impact of burnout on human physiology and on operational performance: A prospective study of soldiers enrolled in the combat diver qualification course. Yale Journal of Biology and Medicine. 2002;75(4):199-205.
10. Binsch O, Banko KM, Veenstra BJ, Valk PJL. Examining the Relationship Between Mental, Physical, and Organizational Factors Associated With Attrition During Maritime Forces Training. The Journal of Strength & Conditioning Research. 2015;29:S187-S91.
11. Teyhen DS, Shaffer SW, Butler RJ, Goffar SL, Kiesel KB, Rhon DI, et al. What Risk Factors Are Associated With Musculoskeletal Injury in US Army Rangers? A Prospective Prognostic Study. Clin Orthop Relat Res. 2015;473(9):2948-58.
12. Billette J-M, Janz T. Injuries in Canada: Insights from the Canadian Community Health Survery. In: Canada S, editor. Ottawa, ON: Government of Canada; 2011. p. 18.
13. Besemann M. Physical rehabilitation following polytrauma. The Canadian Forces Physical Rehabilitation Program 2008-2011. Canadian Journal of Surgery. 2011;54(6):S135-41.
14. Aiken AB, Bélanger SAH. Shaping the future : military and veteran health research: Kingston, Ont. : Canadian Defence Academy Press, c2011; 2011.
15. Hébert LJ, Rowe P. The lessons learned from the canadian forces physiotherapy experience during the peacekeeping operations in Bosnia. Military medicine. 2007;172(8):829-34.
16. Born J. Results from Health and lifestyle information survey of Canadian Forces personnel 2008/2009 [electronic resource] / authors, Jennifer Born ... [et al.]: Ottawa] : National Defence, 2010]; Regular Force version; 2010.
17. Jones BH, Hauschild VD. Physical Training, Fitness, and Injuries: Lessons Learned From Military Studies. The Journal of Strength & Conditioning Research. 2015;29:S57-S64.
18. Brukner P, Khan K. Brukner & Khan's clinical sports medicine / [Peter] Brukner ... [et al.]: Sydney ; New York : McGraw-Hill, c2012; 4th ed; 2012.
19. Pelham TW, White H, Holt LE, Lee SW. The etiology of low back pain in military helicopter aviators: Prevention and treatment. Work. 2005;24(2):101-10.
20. Cohen SP, Griffith S, Larkin TM, Villena F, Larkin R. Presentation, diagnoses, mechanisms of injury, and treatment of soldiers injured in Operation Iraqi Freedom: an epidemiological study conducted at two military pain management centers. Anesthesia and analgesia. 2005;101(4):1098-103, table of contents.
21. Moore JH, Goffar SL, Teyhen DS, Pendergrass TL, Childs JD, Ficke JR. The Role of US Military Physical Therapists During Recent Combat Campaigns. Physical Therapy. 2013;93(9):1268-75.
22. Jennings BM, Yoder LH, Heiner SL, Loan LA, Bingham MO. Soldiers with musculoskeletal injuries. Journal of Nursing Scholarship. 2008;40(3):268-74.
23. Frank AJ. Orthopedic injuries before combat deployment--will the soldiers be ready for combat when their unit is called upon? Military Medicine. 2011;176(9):1015-8.
24. Eilat-Tsanani S, Tabenkin H, Lavie I, Cohen Castel O, Lior M. The effect of low back pain on work absenteeism among soldiers on active service. Spine. 2010;35(19):E995-E9.
25. Cohen SP, Nguyen C, Kapoor SG, Anderson-Barnes VC, Foster L, Shields C, et al. Back pain during war: an analysis of factors affecting outcome. Archives of Internal Medicine. 2009;169(20):1916-23.
26. Cohen SP, Plunkett AR, Wilkinson I, Nguyen C, Kurihara C, Flagg A, 2nd, et al. Headaches during war: analysis of presentation, treatment, and factors associated with outcome. Cephalalgia: An International Journal Of Headache. 2012;32(2):94-108.
27. Adams MS, Croft AM. Sports injuries in British troops deployed on Operation Resolute (Bosnia). J R Army Med Corps. 1997;143(1):35-8.
28. Booth-Kewley S, Larson GE, Highfill-McRoy RM. Psychosocial predictors of return to duty among marine recruits with musculoskeletal injuries. Military Medicine. 2009;174(2):139-52.
29. Watson PJ, Booker CK, Moores L, Main CJ. Returning the chronically unemployed with low back pain to employment. Eur J Pain. 2004;8(4):359-69.
30. Briand C, Durand MJ, St-Arnaud L, Corbiere M. Work and mental health: learning from return-to-work rehabilitation programs designed for workers with musculoskeletal disorders. International journal of law and psychiatry. 2007;30(4-5):444-57.
31. Van Til L, Fikretoglu D, Pranger T, Patten S, Wang J, Wong M, et al. Work reintegration for veterans with mental disorders: a systematic literature review to inform research. Phys Ther. 2013;93(9):1163-74.
32. Loisel P, Anema JR. Handbook of work disability [electronic resource] : prevention and management / Patrick Loisel, Johannes R. Anema, editors: New York, NY : Springer, c2013; 2013.
33. Canada. Government of. Canadian Forces Mental Health Survey, 2013 [Electronic]. Ottawa: Government of Canada; 2014 [updated 11 August 2014; cited 2015 24 December 2015]. Website]. Available from: http://www.statcan.gc.ca/daily-quotidien/140811/dq140811a-eng.htm.
34. Cohen SP, Brown C, Kurihara C, Plunkett A, Nguyen C, Strassels SA. Diagnoses and factors associated with medical evacuation and return to duty for service members participating in Operation Iraqi Freedom or Operation Enduring Freedom: a prospective cohort study. Lancet. 2010;375(9711):301-9.
35. Perera H, Suveendran T, Mariestella A. Profile of psychiatric disorders in the Sri Lanka Air Force and the outcome at 6 months. Military Medicine. 2004;169(5):396-9.
36. Friedman MJ, Schnurr PP, McDonagh-Coyle A. Post-traumatic stress disorder in the military veteran. Psychiatric Clinics of North America. 1994;17(2):265-77.
37. McGeary D, Moore M, Vriend CA, Peterson AL, Gatchel RJ. The evaluation and treatment of comorbid pain and PTSD in a military setting: an overview. Journal Of Clinical Psychology In Medical Settings. 2011;18(2):155-63.
38. Hoge CW, Terhakopian A, Castro CA, Messer SC, Engel CC. Association of posttraumatic stress disorder with somatic symptoms, health care visits, and absenteeism among Iraq war veterans. American Journal of Psychiatry. 2007;164(1):150-3.
39. Barrett DH, Doebbeling CC, Schwartz DA, Voelker MD, Falter KH, Woolson RF, et al. Posttraumatic stress disorder and self-reported physical health status among U.S. Military personnel serving during the Gulf War period: a population-based study. Psychosomatics. 2002;43(3):195-205.
40. Strauss B, editor Forum presentation: Measuring Up? The current health status of CAF personnel. Military and Veteran Health Research Forum; 2015.
41. Spivock M, Mattie P. Warrior Fitness Training Program Follow-Up. Phase 1 Technical Report: Fitness and health behaviours. Technical Report. Ottawa: Departement of National Defence, Defence N; 2013 13 May 2013. Report No.
42. Peake J, Gargett S, Waller M, McLaughlin R, Cosgrove T, Wittert G, et al. The health and cost implications of high body mass index in Australian defence force personnel. BMC Public Health. 2012;12(1):451-60.

43. Batten SV, Pollack SJ. Integrative outpatient treatment for returning service members. Journal Of Clinical Psychology. 2008;64(8):928-39.
44. Fikretoglu D, Guay S, Pedlar D, Brunet A. Twelve month use of mental health services in a nationally representative, active military sample. Medical Care. 2008;46(2):217-23.
45. Carragee EJ, Cohen SP. Lifetime asymptomatic for back pain: the validity of self-report measures in soldiers. Spine. 2009;34(9):978-83.
46. Berkowitz SM. Workplace ergonomic and psychosocial factors in occupational back disorders, healthcare utilization, and lost time: cross-sectional and prospective studies: Uniformed Services University of the Health Sciences; 1999.
47. Gagnon P, Spivock M, Reilly T, Mattie P, Stockbrugger B. The FORCE Fitness Profile—Adding a Measure of Health-Related Fitness to the Canadian Armed Forces Operational Fitness Evaluation. The Journal of Strength & Conditioning Research. 2015;29:S192-S8.
48. Butler D, National Academy of Engineering., Institute of Medicine (U.S.). Systems engineering to improve traumatic brain injury care in the military health system : workshop summary. Washington, D.C.: National Academies Press; 2009. xix, 174 p. p.
49. Songer TJ, LaPorte RE. Disabilities due to injury in the military. American Journal of Preventive Medicine. 2000;18(Supplement 1):33-40.
50. Neal LA, Kiernan M, Hill D, McManus F, Turner MA. Management of mental illness by the British Army. The British Journal Of Psychiatry: The Journal Of Mental Science. 2003;182:337-41.
51. Iles RA, Davidson M, Taylor NF. Psychosocial predictors of failure to return to work in non-chronic non-specific low back pain: a systematic review. Occup Environ Med. 2008;65(8):507-17.
52. Kaptain GJ, Shaffrey CI, Alden TD, Young JN, Whitehill R. The influence of secondary gain on surgical outcome: a comparison between cervical and lumbar discectomy. Neurosurgical Focus. 1998;5(2):e6-e.
53. Aiken B. Supporting Canadian Veterans with Disabilities: a Comparaison of Financial Benefits. Kingston: Queen's University, 2011 Contract No.: 13.
54. Pranger T, Murphy K, Thompson JM. Shaken world: Coping with transition to civilian life. [French, English]. Canadian Family Physician. 2009;55(2):159-61.
55. Canada. Government of. Queen's Regulations and Orders (QR&Os) Volume 1 - Administration [Website]. Ottawa: Government of Canada; 2015 [updated 21 August 2015; cited 2015 26 December 2016]. Website]. Available from: http://www.forces.gc.ca/en/about-policies-standards-queens-regulations-orders-vol-01/index.page.
56. Larsson H, Broman L, Harms-Ringdahl K. Individual risk factors associated with premature discharge from military service. Military Medicine. 2009;174(1):9-20.
57. Larsson H, Tegern M, Harms-Ringdahl K. Influence of the implementation of a comprehensive intervention programme on premature discharge outcomes from military training. Work. 2012;42(2):241-51.
58. Ineson N. Military cardiac rehabilitation. Journal Of The Royal Army Medical Corps. 1992;138(2):63-5.
59. Grenier JL, Swenson JR, FitzGibbon GM, Leach AJ. Psychosocial aspects of coronary artery disease related to military patients. Canadian Journal Of Psychiatry Revue Canadienne De Psychiatrie. 1997;42(2):176-84.
60. Kang DG, Lehman RA, Tracey RW, Cody JP, Rosner MK, Bevevino AJ. Outcomes following cervical disc arthroplasty in an active duty military population. Journal Of Surgical Orthopaedic Advances. 2013;22(1):10-5.
61. Molinari RW, Sloboda JF, Arrington EC. Low-grade isthmic spondylolisthesis treated with instrumented posterior lumbar interbody fusion in U.S. servicemen. Journal Of Spinal Disorders & Techniques. 2005;18 Suppl:S24-S9.
62. Schoenfeld AJ, Thomas D, Bader JO, Bono CM. Transforaminal lumbar interbody fusion: prognostic factors related to retention in an active duty military population. Military Medicine. 2013;178(2):228-33.
63. Tulloch DN, Dewar EP. Early return to work following highly selective vagotomy. Annals Of The Royal College Of Surgeons Of England. 1989;71(6):347-8.
64. Weinstein ML. An ankle protocol for second-degree ankle sprains. Military Medicine. 1993;158(12):771-4.
65. Chapman TT, Richard RL, Hedman TL, Chisholm GB, Quick CD, Baer DG, et al. Military return to duty and civilian return to work factors following burns with focus on the hand and literature review. Journal of Burn Care & Research. 2008;29(5):756-62.
66. Cohen SP, Kapoor SG, Nguyen C, Anderson-Barnes VC, Brown C, Schiffer D, et al. Neck pain during combat operations: an epidemiological study analyzing clinical and prognostic factors. Spine. 2010;35(7):758-63.
67. Kishbaugh D, Dillingham TR, Howard RS, Sinnott MW, Belandres PV. Amputee soldiers and their return to active duty. Military Medicine. 1995;160(2):82-4.
68. Tennent DJ, Wenke JC, Rivera JC, Krueger CA. Characterisation and outcomes of upper extremity amputations. Injury. 2014;45(6):965-9.
69. Belisle JG, Wenke JC, Krueger CA. Return-to-duty rates among US military combat-related amputees in the global war on terror: Job description matters. Journal of Trauma & Acute Care Surgery. 2013;75(2):279-86.
70. Dharm-Datta S, Etherington J, Mistlin A, Rees J, Clasper J. The outcome of British combat amputees in relation to military service. Injury. 2011;42(11):1362-7.
71. Thompson JM, Chiasson R, Loisel P, Besemann LC, Pranger T. A sailor's pain: Veterans' musculoskeletal disorders, chronic pain, and disability. Canadian Family Physician. 2009;55(11):1085-8.
72. Aiken A. The Unique Health and Rehabilitation Needs of Those Who Serve or Have Served. Physical Therapy. 2013;93(9):1157-.
73. Godlewski RT. A Model of Voluntary Turnover in Male Canadian Forces Recruits. Military Psychology (Taylor & Francis Ltd). 2012;24(3):251-65.
74. Cohen SI, Suri P, Amick MM, Yan K. Clinical and demographic factors associated with employment status in US military veterans returning from Iraq and Afghanistan. Work (Reading, Mass). 2013;44(2):213-9.
75. Gowan MA, Craft SL, Zimmermann RA. Response to work transitions by United States Army personnel: effects of self-esteem, self-efficacy, and career resilience. Psychological reports. 2000;86(3 Pt 1):911-21.
76. Mason C, Freeman N, Weintraub A. Military transition back to the community: Regaining a sense of belongingness. Brain Injury. 2012;26 (4-5):309-10.
77. Cooney G. Exercise for depression. Journal of Evidence-Based Medicine. 2013;6(4):307-8.
78. Rethorst CD, Trivedi MH. Evidence-based recommendations for the prescription of exercise for major depressive disorder. Journal of psychiatric practice. 2013;19(3):204-12.
79. Silverman MN, Deuster PA. Biological mechanisms underlying the role of physical fitness in health and resilience. Interface Focus. 2014;4(5):20140040-.
80. Joshi C, Jayasinghe UW, Parker S, Del Mar C, Russell G, Lloyd J, et al. Does health literacy affect patients' receipt of preventative primary care? A multilevel analysis. BMC Fam Pract. 2014;15(1):171.
81. Zhang X, Zhou L. Cochrane review summary for cancer nursing: interventions to enhance return to work for cancer patients. Cancer Nursing. 2013;36(1):4-5.
82. Schaafsma FG, Whelan K, van der Beek AJ, van der Es-Lambeek LC, Ojajärvi A, Verbeek JH. Physical conditioning as part of a return to work strategy to reduce sickness absence for workers with back pain. The Cochrane database of systematic reviews. 2013;8:CD001822.
83. Spruit MA, Pitta F, Garvey C, ZuWallack RL, Roberts CM, Collins EG, et al. Differences in content and organisational aspects of pulmonary rehabilitation programmes. EUROPEAN RESPIRATORY JOURNAL. 2014;43(5):1326-37.
84. Jessup RL. Interdisciplinary versus multidisciplinary care teams: do we understand the difference? Aust Health Rev. 2007;31(3):330-1.
85. Williams R, Austin J. Cardiac rehabilitation supports a heterogeneous population of patients. Heart (British Cardiac Society). 2012;98(8):673; author reply -4.
86. Strasser DC, Uomoto JM, Smits SJ. The interdisciplinary team and polytrauma rehabilitation: prescription for partnership. Archives of Physical Medicine & Rehabilitation. 2008;89(1):179-81.
87. Prvu Bettger JA, Stineman MG. Effectiveness of multidisciplinary rehabilitation services in postacute care: state-of-the-science. A review. Archives of Physical Medicine & Rehabilitation. 2007;88(11):1526-34.
88. Rice-Oxley M, Turner-Stokes L. Effectiveness of brain injury rehabilitation. Clinical Rehabilitation. 1999;13(1):7-24.
89. Tyerman A. Outcome Measurement in a Community Head Injury Service. Neuropsychological Rehabilitation. 1999;9(3/4):481-91.

90. Handoll HH, Cameron ID, Mak JC, Finnegan TP. Multidisciplinary rehabilitation for older people with hip fractures. Cochrane Database of Systematic Reviews. 2009(4).
91. Feuerstein M, Menz L, Zastowny T, Barron BA. Chronic back pain and work disability: Vocational outcomes following multidisciplinary rehabilitation. Journal Of Occupational Rehabilitation. 1994;4(4):229-51.
92. Kuukkanen T, Malkia E. Muscular performance after a 3 month progressive physical exercise program and 9 month follow-up in subjects with low back pain. A controlled study. Scandinavian Journal of Medicine & Science in Sports. 1996;6(2):112-21.
93. Loisel P, Abenhaim L, Durand P, Esdaile JM, Suissa S, Gosselin L, et al. A population-based, randomized clinical trial on back pain management. Spine. 1997;22(24):2911-8.
94. Durand MJ, Vachon B, Loisel P, Berthelette D. Constructing the program impact theory for an evidence-based work rehabilitation program for workers with low back pain. Work. 2003;21(3):233-42.
95. Momsen AM, Rasmussen JO, Nielsen CV, Iversen MD, Lund H. Multidisciplinary team care in rehabilitation: an overview of reviews. Journal of rehabilitation medicine : official journal of the UEMS European Board of Physical and Rehabilitation Medicine. 2012;44(11):901-12.
96. Kamper SJ, Apeldoorn AT, Chiarotto A, Smeets RJEM, Ostelo RWJG, Guzman J, et al. Multidisciplinary biopsychosocial rehabilitation for chronic low back pain: Cochrane systematic review and meta-analysis. BMJ: British Medical Journal. 2015;350(7995):h444-h 1p.
97. Eldar R, Jelic M. The association of rehabilitation and war. Disability & Rehabilitation. 2003;25(18):1019-23.
98. Tupper DE. Chapter 53: rehabilitation therapies. Handbook Of Clinical Neurology. 95. Netherlands2010. p. 851-67.
99. Brown HV, Hollis V. The meaning of occupation, occupational need, and occupational therapy in a military context. Phys Ther. 2013;93(9):1244-53.
100. Montz R, Gonzales F, Jr., Bash DS, Carney A, Bramlett D. Occupational therapy role on the battlefield: an overview of combat and operational stress and upper extremity rehabilitation. Journal of hand therapy : official journal of the American Society of Hand Therapists. 2008;21(2):130-5; quiz 6.
101. Sayer NA, Cifu DX, McNamee S, Chiros CE, Sigford BJ, Scott S, et al. Rehabilitation needs of combat-injured service members admitted to the VA Polytrauma Rehabilitation Centers: the role of PM&R in the care of wounded warriors. PM & R: The Journal Of Injury, Function, And Rehabilitation. 2009;1(1):23-8.
102. Doukas WC, Pasquina PF, Gambel J, Foster LS. Process of care for battle casualties at the Walter Reed Army Medical Center: part III. Physical medicine and rehabilitation service. Military Medicine. 2006;171(3):206-8.
103. Facione J, Rogez D, Stephan A, Lapeyre E. The military Physical Medicine and Rehabilitation and the socio-medical action: Building multidisciplinary an integrative approach in favor of war wounded soldiers. Annals of Physical and Rehabilitation Medicine. 2013;56:e67.
104. Eriawati D. Rehabilitation for disabled Indonesia military. Journal of Rehabilitation Medicine (Stiftelsen Rehabiliteringsinformation)2012. p. 89-.
105. Chahal AS. Care of spinal cord in the armed forces of India. Paraplegia. 1975;13(1):25-8.
106. Friedl KE, Knapik JJ, Häkkinen K, Baumgartner N, Groeller H, Taylor NAS, et al. Perspectives on Aerobic and Strength Influences on Military Physical Readiness: Report of an International Military Physiology Roundtable. The Journal of Strength & Conditioning Research. 2015;29:S10-S23.
107. Wilken JM, Darter BJ, Goffar SL, Ellwein JC, Snell RM, Tomalis EA, et al. Physical performance assessment in military service members. The Journal of the American Academy of Orthopaedic Surgeons. 2012;20 Suppl 1:S42-S7.
108. Fisher J, Steele J. Questioning the Resistance/Aerobic Training Dichotomy: A commentary on physiological adaptations determined by effort rather than exercise modality. Journal of Human Kinetics. 2014;44:137-42.
109. Kraemer WJ, Szivak TK. Strength training for the warfighter.(Author abstract)(Report). Journal of Strength and Conditioning Research. 2012(7):107.
110. Gibala MJ, Gagnon PJ, Nindl BC. Military Applicability of Interval Training for Health and Performance. The Journal of Strength & Conditioning Research. 2015;29:S40-S5.
111. Gatchel RJ, Mayer TG. Testing minimal clinically important difference: additional comments and scientific reality testing. The spine journal : official journal of the North American Spine Society. 2010;10(4):330-2.
112. Pedler A, Sterling M. Patients with chronic whiplash can be subgrouped on the basis of symptoms of sensory hypersensitivity and posttraumatic stress. Pain. 2013;154(9):1640-8.
113. Fishbain DA, Goldberg M, Meagher BR, Steele R, Rosomoff H. Male and female chronic pain patients categorized by DSM-III psychiatric diagnostic criteria. Pain (03043959). 1986;26(2):181-97.
114. Hulley SB. Designing clinical research. 4th ed. Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins; 2013.
115. Carter RE, Lubinsky J, Domholdt E. Rehabilitation research : principles and applications. 4th ed. St. Louis, Mo.: Elsevier Saunders; 2011. viii, 503 p. p.
116. Gross DP, Asante AK, Miciak M, Battié MC, Carroll LJ, Sun A, et al. Are Performance-Based Functional Assessments Superior to Semistructured Interviews for Enhancing Return-to-Work Outcomes? Archives of Physical Medicine and Rehabilitation. 2014;95(5):807-15.e1.
117. Gross DP, Battié MC. Factors Influencing Results of Functional Capacity Evaluations in Workers' Compensation Claimants With Low Back Pain. Physical Therapy. 2005;85(4):315-22.
118. Gross DP, Battie MC. Work-related recovery expectations and the prognosis of chronic low back pain within a workers' compensation setting. 2005:428.
119. Gross DP, Battié MC. Predicting timely recovery and recurrence following multidisciplinary rehabilitation in patients with compensated low back pain. Spine. 2005;30(2):235-40.
120. Malish RG, Maxwell GL, Arnett AD, Cassidy JM, Place RJ. The effectiveness of soldier medical readiness councils in reducing and shaping the population of soldiers not medically deployable. Military Medicine. 2013;178(7):715-21.
121. Wesson M, Whybrow D, Gould M, Greenberg N. An Initial Evaluation of the Clinical and Fitness for Work Outcomes of a Military Group Behavioural Activation Programme (English). Behavioural and cognitive psychotherapy (Print). 2014;42(2):243-7.
122. McCurdie I, Carter N. Vocational rehabilitation. Armed services may provide model. BMJ (Clinical Research Ed). 2001;323(7322):1186-7.
123. Roberts AJ, Franklyn-Miller A, Etherington J. A new functional outcome assessment tool for military musculoskeletal rehabilitation: a pilot validation study. PM & R: The Journal Of Injury, Function, And Rehabilitation. 2011;3(6):527-32.
124. Canada. Government of. Organizational Structure [Website]. Ottawa: Government of Canada; 2016 [updated 23 May 2014; cited 2016 25 Febuary 2016]. Website]. Available from: http://www.forces.gc.ca/en/about-org-structure/index.page.
125. Canada. Government of. Canadian Armed Forces Medical Standards (CFP 154) [Website]. Ottawa: Government of Canada; 2015 [updated 6 January 2015; cited 2015 5 May 2015]. Website]. Available from: http://www.forces.gc.ca/en/about-policies-standards-medical-occupations/index.page.
126. Canada. Government of. Pamphlet: Administrative Review Medical Employment Limitations (AR/MEL). In: Canadian Forces MCD, editor. Electronic Publication: Government of Canada; ND. p. 2.
127. Canada. Government of. Defence Administrative Orders and Directives (DAODs) - 5000 [Website]. Ottawa: Government of Canada; 2010 [updated 22 December 2015; cited 2015 26 December 2015]. Website]. Available from: http://www.forces.gc.ca/en/about-policies-standards-defence-admin-orders-directives-5000/index.page.
128. Canada. Government of. The Guide to Benefits, Programs, and Services for Serving and Former Canadian Armed Forces Members and their Families [Government Website]. Ottawa: Government of Canada; 2015 [updated 19 November 2015; cited 2015 24 December 2015]. Website]. Available from: http://www.forces.gc.ca/en/caf-community-benefits-ill-injured-deceased/guide-toc.page.
129. Rossi PH, Lipsey MW, Freeman HE. Evaluation : a systematic approach. 7th ed. Thousand Oaks, Calif.: Sage Publications; 2004. x, 470 p. p.
130. Crumback D, Perigny-Lajoie S, Weimann C, Cormier C, editors. Joint Personnel Support Unit (JPSU) Return to Work (RTW) Program - A Pilot. Military and Veteran Health Research Forum; 2013; Edmonton, AB. Edmonton2013.
131. Jones C, Perigny-Lajoie S, Crumback D, editors. The development of a health and work literacy component of the Return to Duty intervention for ill and injured members within the Canadian Armed Forces. Military and Veteran Health Research Forum; 2015 23 November 2015; Quebec City, QC2015.

132. Rothman KJ. Epidemiology : an introduction. 2nd ed. New York, NY: Oxford University Press; 2012. viii, 268 p. p.
133. Canadian Forces Morale & Welfare Services. The FORCE program [Webpage]. Ottawa2015 [updated 2015-09-10; cited 2015 1 December]. Corporate webpage]. Available from: http://www.cfmws.com/forceprogram.
134. McGill S. Low back disorders : evidence-based prevention and rehabilitation / Stuart McGill: Champaign, IL : Human Kinetics, 2007; 2nd ed; 2007.
135. Parkkari J, Taanila H, Suni J, Mattila VM, Ohrankammen O, Vuorinen P, et al. Neuromuscular training with injury prevention counselling to decrease the risk of acute musculoskeletal injury in young men during military service: a population-based, randomised study.(Research article)(Clinical report). BMC medicine. 2011.
136. Suni J, Rinne M, Natri A, Statistisian MP, Parkkari J, Alaranta H. Control of the lumbar neutral zone decreases low back pain and improves self-evaluated work ability: a 12-month randomized controlled study. Spine. 2006;31(18):E611-20.
137. Holopainen K, Nevala N, Kuronen P, Arokoski JPA. Effects of vocationally oriented medical rehabilitation for aircraft maintenance personnel -- a preliminary study of long-term effects with 5-year follow-up. Journal of Occupational Rehabilitation. 2004;14(4):233-42.
138. Everett G. Olympic Weightlifting : A Complete Guide for Athletes & Coaches: Createspace Independent Pub
Createspace Independent Pub, Platform, 7290 B Investment Dr, North Charleston, SC, 29418; 2009.
139. Houglum PA. Therapeutic exercise for musculoskeletal injuries: Champaign, IL : Human Kinetics, c2010.
3rd ed.; 2010.
140. Hoffman J, National Strength & Conditioning Association (U.S.). NSCA's guide to program design. Champaign, IL: Human Kinetics; 2012. ix, 325 p. p.
141. Laframboise J, Stockbrugger B. Effect of 12-weeks of DFit.ca fintess training on the performance of the FORCE evaluation and the Common Military Task Fitness Evaluation in CAF personnel. In: Development DoF-HPRa, editor. Military and Veterans Health Researh Forum; Edmonton, AB: Canadian Forces Morale & Welfare Services; 2013.
142. Pilch SB, Rodriguez K, Rudolph K, Swiatek N, Zawisky JP, Schenk RJ. Relationship among performance on the Selective Functional Movement Assessment and NDI and ODI scores in patients with spine pain. Orthopaedic Physical Therapy Practice. 2012;24(1):22-7.
143. Krause DA, Cloud BA, Forster LA, Schrank JA, Hollman JH. Measurement of Ankle Dorsiflexion: A Comparison of Active and Passive Techniques in Multiple Positions. Journal of Sport Rehabilitation. 2011;20(3):333-44.
144. Majlesi J, Togay H, Unalan H, Toprak S. The sensitivity and specificity of the Slump and the Straight Leg Raising tests in patients with lumbar disc herniation. Journal of Clinical Rheumatology. 2008;14(2):87-91.
145. Bloom M, Fischer J, Orme JG. Evaluating practice : guidelines for the accountable professional. 6th ed. Boston: Pearson/Allyn and Bacon; 2009. xxiii, 610 p. p.
146. Backman CL, Harris SR, Chisholm J-AM, Monette AD. Review article: Single-subject research in rehabilitation: A review of studies using AB, withdrawal, multiple baseline, and alternating treatments designs. Archives of Physical Medicine and Rehabilitation. 1997;78:1145-53.
147. Horner RH, Carr EG, Halle J, McGee G, Odom S, Wolery M. The Use of Single-Subject Research to Identify Evidence-Based Practice in Special Education. Exceptional children. 2005;71(2):165-79.
148. Hayes SC, Blackledge JT. 3.02: Single Case Experimental Designs: Clinical Research and Practice. Comprehensive Clinical Psychology. 1998:23-45.
149. Tate RL, McDonald S, Perdices M, Togher L, Schultz R, Savage S. Rating the methodological quality of single-subject designs and n-of-1 trials: Introducing the Single-Case Experimental Design (SCED) Scale. Neuropsychological Rehabilitation. 2008;18(4):385-401.
150. Lenz AS. Calculating effect size in single-case research: a comparison of nonoverlap methods.(Report). Measurement and Evaluation in Counseling and Development. 2013(1):64.
151. Brossart DF, Parker RI, Castillo LG. Robust regression for single-case data analysis: how can it help? Behav Res Methods. 2011;43(3):710-9.
152. Patton MQ. Utilization-focused evaluation. 4th ed. Thousand Oaks: Sage Publications; 2008. xx, 667 p. p.
153. Ottenbacher KJ. Evaluating clinical change : strategies for occupational and physical therapists. Baltimore, MD, U.S.A.: Williams & Wilkins; 1986. xiv, 243 p. p.
154. Kratochwill TR, Hitchcock JH, Horner RH, Levin JR, Odom SL, Rindskopf DM, et al. Single-Case Intervention Research Design Standards. 2013. p. 26-38.
155. Kratochwill TR, Hitchcock J, Horner RH, Levin JR, Odom SL, Rindskopf DM, et al. Single-Case Designs Technical Documentation. What Works Clearinghouse, 2010 Contract No.: Report.
156. Gast DL, Ledford JR. Single Case Research Methodology Applications in Special Education and Behavioral Sciences. 2nd ed. Hoboken: Taylor and Francis; 2014. 1 online resource (439 p.) p.
157. Kazdin AE. Single-case research designs : methods for clinical and applied settings / Alan E. Kazdin: New York : Oxford University Press, 2011; 2nd ed; 2011.
158. Theriault F, editor Presented in: Clustering of behavioral risk factors in CAF personnel and impact on adverse health conditions Military and Veteran Health Research Forum 2015; 23-25 November 2015.
159. Poisson R. The imperative of military medical research and the duty to protect, preserve and provide advanced evidence-informed care. Journal of Military, Veteran and Family Health. 2015;1(1):91.
160. Zamorski MA, Boulos D. The impact of the military mission in Afghanistan on mental health in the Canadian Armed Forces: a summary of research findings. European Journal of Psychotraumatology. 2014;5:1.
161. Erickson J, Kinley DJ, Afifi TO, Zamorski MA, Pietrzak RH, Stein MB, et al. Epidemiology of generalized anxiety disorder in Canadian military personnel. Journal of Military, Veteran and Family Health. 2015;1(1):91.
162. Ferron J, Jones PK. Tests for the Visual Analysis of Response-Guided Multiple-Baseline Data. 2006:66.
163. Gross DP, Algarni FS, Niemeläinen R. Reference values for the SF-36 in Canadian injured workers undergoing rehabilitation. Journal Of Occupational Rehabilitation. 2015;25(1):116-26.
164. Sleeth JE. Return to work compliance toolkit: Scarborough, Ont. : Carswell, c2000-; 2000.
165. Salazar AM, Warden DL, Schwab K, Spector J, Braverman S, Walter J, et al. Cognitive rehabilitation for traumatic brain injury: A randomized trial. Defense and Veterans Head Injury Program (DVHIP) Study Group. JAMA: The Journal Of The American Medical Association. 2000;283(23):3075-81.
166. Bolton K, Zimmerman S, Bloom E, Hunter M, West K, Hunt A, et al. The enhanced reintegration action plan: the Madigan experience. US Army Medical Department Journal. 2008:38-44.
167. Campello M, Ziemke G, Hiebert R, Weiser S, Brinkmeyer M, Fox B, et al. Implementation of a multidisciplinary program for active duty personnel seeking care for low back pain in a U.S. Navy Medical Center: a feasibility study. Military medicine. 2012;177(9):1075-80.
168. Gajewski D, Granville R. The United States Armed Forces Amputee Patient Care Program. The Journal of the American Academy of Orthopaedic Surgeons. 2006;14(10 Spec No.):S183-S7.
169. Gatchel RJ, McGeary DD, Peterson A, Moore M, LeRoy K, Islert WC, et al. Preliminary Findings of a Randomized Controlled Trial of an Interdisciplinary Military Pain Program. MILITARY MEDICINE. 2009;174(3):270-7.
170. Goss DL, Christopher GE, Faulk RT, Moore J. Functional training program bridges rehabilitation and return to duty. Journal Of Special Operations Medicine: A Peer Reviewed Journal For SOF Medical Professionals. 2009;9(2):29-48.
171. Gamble JAA. A developmental evaluation primer. JW McConnell Familly Foundation. 2008.
172. Shirado O, Doi T, Akai M, Hoshino Y, Fujino K, Hayashi K, et al. Multicenter Randomized Controlled Trial to Evaluate the Effect of Home-Based Exercise on Patients With Chronic Low Back Pain The Japan Low Back Pain Exercise Therapy Study. Spine. 2010;35(17):E811-E9.
173. Wenger HA. The AFM - CrossFit Final Report. Internal Report. Ottawa: Canadian Forces Morale & Welfare Services, Promotion HPH; 2006 11 December 2006. Report No.
174. Fisher J, Steele J, Bruce-Low S, Smith D. Evidence-Based Resistance Training Recommendations. Medicina Sportiva. 2011;15(3):147-62.
175. Carpinelli RN, Otto RM, Winnett RA. A Critical Analysis of the Acsm Position Stand on Resistance Training: Insufficient Evidence to Support Recommended Training Protocols. Journal of Exercise Physiology Online. 2004;7(3):1-60.

176. Drain JR, Sampson JA, Billing DC, Burley SD, Linnane DM, Groeller H. The Effectiveness of Basic Military Training To Improve Functional Lifting Strength in New Recruits. The Journal of Strength & Conditioning Research. 2015;29:S173-S7.
177. Mannion AF, Taimela S, Müntener M, Dvorak J. Active therapy for chronic low back pain part 1. Effects on back muscle activation, fatigability, and strength. Spine. 2001;26(8):897-908.
178. Kraemer WJ, Fleck SJ. Optimizing strength training : designing nonlinear periodization workouts / William J. Kraemer, Steven J. Fleck: Champaign, IL : Human Kinetics, c2007; 2007.
179. Ehrman JK. ACSM's resource manual for Guidelines for exercise testing and prescription / American College of Sports Medicine ; senior editor, Jonathan K. Ehrman ; section editors, Adam deJong ... [et al.]: Philadelphia : Wolters Kluwer Health/Lippincott Williams & Wilkins, c2010; 6th ed; 2010.
180. Hou W-H, Chi C-C, Lo H-LD, Kuo KN, Chuang H-Y. Vocational rehabilitation for enhancing return-to-work in workers with traumatic upper limb injuries. The Cochrane database of systematic reviews. 2013;10:CD010002.
181. Durand MJ, Loisel P, Durand P. Le Retour Therapeutique au Travail comme une intervention de readaptation centralisee dans le milieu de travail: description et fondements theoriques. Canadian Journal of Occupational Therapy. 1998(2):72.
182. Jay K, Frisch D, Hansen K, Zebis MK, Andersen CH, Mortensen OS, et al. Kettlebell training for musculoskeletal and cardiovascular health: a randomized controlled trial. Scandinavian Journal of Work, Environment & Health. 2011;37(3):196-203.
183. Backman CL, Harris SR. Case studies, single-subject research, and N of 1 randomized trials: comparisons and contrasts. American Journal of Physical Medicine & Rehabilitation. 1999;78(2):170-6.
184. Janosky JE. Single subject designs in biomedicine [electronic resource]: Dordrecht The Netherlands] ; New York : Springer, c2009; 2009.
185. Canadian Society for Exercise Physiology. Canadian Society for Exercise Physiology-Physical Activity Training for Health (CSEP-PATH). Ottawa, ON: Canadian Society for Exercise Physiology; 2013. v, 210 pages p.
186. International Classification of Functioning Disability and Health (ICF). Geneva, Switzerland: World Health Organization; 2001.
187. Rutherford WJ, Diemer GA, Scott ED. Comparison of Bioelectrical Impedance and Skinfolds with Hydrodensitometry in the Assessment of Body Composition in Healthy Young Adults. ICHPER - - SD Journal of Research in Health, Physical Education, Recreation, Sport & Dance. 2011;6(2):56-60.
188. Dite W, Temple VA. A clinical test of stepping and change of direction to identify multiple falling older adults. ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION. 2002;83(11):1566-71.
189. Csuka M, McCarty DJ. Simple method for measurement of lower extremity muscle strength. The American Journal Of Medicine. 1985;78(1):77-81.
190. Whitney SL, Wrisley DM, Marchetti GF, Gee MA, Redfern MS, Furman JM. Clinical Measurement of Sit-to-Stand Performance in People With Balance Disorders: Validity of Data for the Five-Times-Sit-to-Stand Test. Physical therapy. 2005;85(10):1034-45.
191. Meretta BM, Whitney SL, Marchetti GF, Sparto PJ, Muirhead RJ. The five times sit to stand test: responsiveness to change and concurrent validity in adults undergoing vestibular rehabilitation. Journal Of Vestibular Research: Equilibrium & Orientation. 2006;16(4-5):233-43.
192. Ortega FB, Silventoinen K, Tynelius P, Rasmussen F. Muscular strength in male adolescents and premature death: cohort study of one million participants. BMJ (Clinical Research Ed). 2012;345:e7279-e.
193. Silventoinen K, Magnusson PKE, Tynelius P, Batty GD, Rasmussen F. Association of body size and muscle strength with incidence of coronary heart disease and cerebrovascular diseases: a population-based cohort study of one million Swedish men. Int J Epidemiol. 2009;38(1):110-8.
194. Trampisch US, Franke J, Jedamzik N, Hinrichs T, Platen P. Optimal Jamar dynamometer handle position to assess maximal isometric hand grip strength in epidemiological studies. The Journal of hand surgery. 2012;37(11):2368-73.
195. King T. Interinstrument Reliability of the Jamar Electronic Dynamometer and Pinch Gauge Compared With the Jamar Hydraulic Dynamometer and B&L Engineering Mechanical Pinch Gauge. American Journal of Occupational Therapy. 2013;67(4):480-3.
196. Hamilton GF, McDonald C, Chenier TC. Measurement of grip strength: validity and reliability of the sphygmomanometer and Jamar grip dynamometer. Journal of Orthopaedic & Sports Physical Therapy. 1992;16(5):215-9.
197. Lang CE, Edwards DF, Birkenmeier RL, Dromerick AW. Original article: Estimating Minimal Clinically Important Differences of Upper-Extremity Measures Early After Stroke. Archives of Physical Medicine and Rehabilitation. 2008;89:1693-700.
198. Anderson MK, Grier T, Canham-Chervak M, Bushman TT, Jones BH. Risk factors associated with higher body fat in US Army female soldiers. US Army Med Dep J. 2014:75-82.
199. Friedl KE. Body composition and military performance--many things to many people. Journal Of Strength And Conditioning Research / National Strength & Conditioning Association. 2012;26 Suppl 2:S87-S100.
200. Ricciardi R. Effects of Gender and Body Adiposity on Physiological Responses to Physical Work While Wearing Body Armor. Military medicine. 2007;172(7):743-8.
201. Morken T, Magerøy N, Moen BE. Physical activity is associated with a low prevalence of musculoskeletal disorders in the Royal Norwegian Navy: a cross sectional study. BMC Musculoskeletal Disorders. 2007;8:56-.
202. Canadian Forces Morale & Welfare Services. A Case for Assessing Aerobic Fitness and Body Composition Within the FORCE Evaluation. Tehnical Report (internal). Ottawa: Canadian Forces Morale & Welfare Services, Development PDoFHPRa; 2014 20 Febuary 2014. Report No.
203. WELLTEC L. Skyndex Skinfold Caliper System 1 Instruction Manual. In: WELLTEC L, editor. Albuquerque, NM: WELLTEC, LLC.; 2012. p. 9-13.
204. Margoti T. Comparison of Results between the Equations of Body Composition of Jackson & Pollock of Three and Seven Skinfolds. / ComparaciÓn De Resultados Entre Las Ecuaciones De La ComposiciÓn Corporal De Jackson & Pollock De Tres Y Siete Pliegues CutÁneos. / ComparaÇÃo De Resultado Entre as EquaÇÕes De Composi&#0007;Ão Corporal De Jackson & Pollock De TrÊs E Sete Dobras CutÂneas. Fitness & Performance Journal (Online Edition). 2009;8(3):191-8.
205. Schmidt PK, Carter JE. Static and dynamic differences among five types of skinfold calipers. Human Biology. 1990;62(3):369-88.
206. Zando KA, Robertson RJ. The validity and reliability of the Cramer Skyndex Caliper in the estimation of percent body fat. Athletic Training. 1987;22(1):23-5.
207. Vogel JA, Crowdy JP, Amor AF, Worsley DE. Changes in aerobic fitness and body fat during army recruit training. / Modifications de la capacite aerobie et de la graisse corporelle pendant l ' entrainement militaire d ' incorporation. European Journal of Applied Physiology & Occupational Physiology. 1978;40(1):37-43.
208. Verweij LM, Terwee CB, Proper KI, Hulshof CTJ, van Mechelen W. Measurement error of waist circumference: gaps in knowledge. Public health nutrition. 2013;16(2):281-8.
209. Bernritter JA, Johnson JL, Woodard SL. Validation of a novel method for measuring waist circumference. Plastic Surgical Nursing: Official Journal Of The American Society Of Plastic And Reconstructive Surgical Nurses. 2011;31(1):9-13.
210. Stratford P, Gill C, Westaway M, Binkley J. Assessing disability and change on individual patients: a report of a patient specific measure. Physiotherapy Canada. 1995;47(4):258-63.
211. Kowalchuk Horn K, Jennings S, Richardson G, Van Vliet D, Hefford C, Haxby Abbott J. The Patient-Specific Functional Scale: Psychometrics, Clinimetrics, and Application as a Clinical Outcome Measure. Journal of Orthopaedic & Sports Physical Therapy. 2012;42(1):30-42.
212. Gross DP, Battié MC, Asante AK. The Patient-Specific Functional Scale: Validity in Workers' Compensation Claimants. Archives of Physical Medicine and Rehabilitation. 2008;89(7):1294-9.
213. Berghmans DD, Lenssen AF, van Rhijn LW, de Bie RA. Patient Specific Function Scale: Its Reliability and Responsiveness in Patients Undergoing a Total Knee Arthroplasty. J Orthop Sports Phys Ther. 2015:1-22.
214. Abbott JH, Schmitt J. Minimum Important Differences for the Patient-Specific Functional Scale, 4 Region-Specific Outcome Measures, and the Numeric Pain Rating Scale. The Journal Of Orthopaedic And Sports Physical Therapy. 2014.
215. de Zwart BCH, Frings-Dresen M, van Duivenbooden JC. Test-retest reliability of the Work Ability Index questionnaire. Occupational medicine (Oxford, England). 2002;52(4):177-81.
216. Jaeschke R, Singer J, Guyatt GH. Measurement of health status. Ascertaining the minimal clinically important difference. Control Clin Trials. 1989;10(4):407-15.

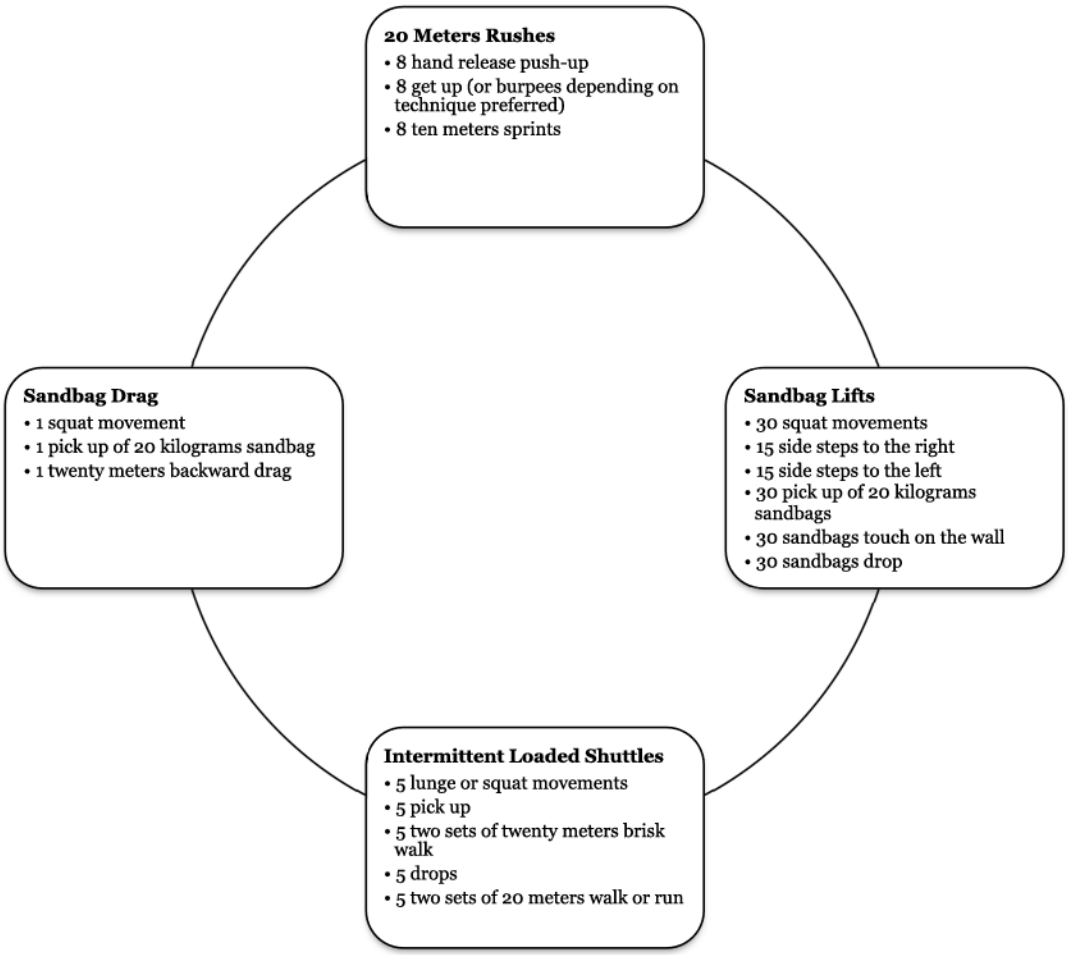
217. Guyatt GH, Osoba D, Wu AW, Wyrwich KW, Norman GR, Clin Significance Consensus M. Methods to explain the clinical significance of health status measures. Mayo Clinic Proceedings. 2002;77(4):371-83.
218. Dunkley BT, Sedge PA, Doesburg SM, Grodecki RJ, Jetly R, Shek PN, et al. Theta, Mental Flexibility, and Post-Traumatic Stress Disorder: Connecting in the Parietal Cortex. PLoS ONE. 2015;10(4):1-17.
219. Dunkley BT, Doesburg SM, Sedge PA, Grodecki RJ, Shek PN, Pang EW, et al. Resting-state hippocampal connectivity correlates with symptom severity in post-traumatic stress disorder. NeuroImage: Clinical. 2014;5:377-84.
220. Pang EW, Sedge P, Grodecki R, Robertson A, MacDonald MJ, Jetly R, et al. Colour or shape: examination of neural processes underlying mental flexibility in posttraumatic stress disorder. Translational Psychiatry. 2014;4:e421-e.
221. Löwe B, Schenkel I, Carney-Doebbeling C, Göbel C. Responsiveness of the PHQ-9 to Psychopharmacological Depression Treatment. Psychosomatics. 2006;47(1):62-7.
222. Davenport TE, Stevens SR, Baroni K, Mark VN, Snell CR. Reliability and validity of Short Form 36 Version 2 to measure health perceptions in a sub-group of individuals with fatigue. Disability & Rehabilitation. 2011;33(25):2596-604.
223. Caillard C, Sebag F, Mathonnet M, Gibelin H, Brunaud L, Loudot C, et al. Prospective evaluation of quality of life (SF-36v2) and nonspecific symptoms before and after cure of primary hyperparathyroidism (1-year follow-up). Surgery. 2007;141(2):153-9.
224. Doerfler LA, Addis ME, Moran PW. Evaluating mental health outcomes in an inpatient setting: convergent and divergent validity of the OQ-45 and BASIS-32. The Journal Of Behavioral Health Services & Research. 2002;29(4):394-403.
225. Okiishi JC, Lambert MJ, Eggett D, Nielsen L, Dayton DD, Vermeersch DA. An analysis of therapist treatment effects: toward providing feedback to individual therapists on their clients' psychotherapy outcome. Journal of clinical psychology. 2006;62(9):1157-72.
226. OQ Measures LLC. OQ 45.2 Administration and Scoring Manual. Administration and Scoring Manual. Salt Lake City, UT: OQ Measures L.L.C., 2013 October 2013. Report No.
227. Boulos D, Zamorski MA. Deployment-related mental disorders among Canadian Forces personnel deployed in support of the mission in Afghanistan, 2001-2008. CMAJ: Canadian Medical Association Journal = Journal De L'association Medicale Canadienne. 2013;185(11):E545-E52.
228. Barnett SD, Heinemann AW, Libin A, Houts AC, Gassaway J, Sen-Gupta S, et al. Small N designs for rehabilitation research. Journal of Rehabilitation Research & Development. 2012;49(1):175-86.
229. King MT. A point of minimal important difference (MID): a critique of terminology and methods. Expert Rev Pharmacoecon Outcomes Res. 2011;11(2):171-84.
230. Nourbakhsh MR, Ottenbacher KJ. The statistical analysis of single-subject data: a comparative examination. Physical therapy. 1994;74(8):768-76.
231. Wheeler DJ. Understanding variation : the key to managing chaos. 2nd ed. Knoxville, Tenn.: SPC Press; 2000. x, 162 p. p.
232. Doty LA. Statistical process control. New York: Industrial Press; 1990. 334 p p.
233. Carr JE, Burkholder EO. Creating single-subject design graphs with Microsoft Excel. Journal of Applied Behavior Analysis. 1998(2):245.
234. Hillman HL, Miller LK. Designing multiple baseline graphs using Microsoft Excel[TM]. The Behavior Analyst Today. 2004(4):372.
235. Pritchard JK. A decade later: creating single-subject design graphs with Microsoft Excel 2007[TM]. The Behavior Analyst Today. 2008(3-4):153.
236. Dixon MR, Jackson JW, Small SL, Horner-King MJ, Lik NMK, Garcia Y, et al. CREATING SINGLE-SUBJECT DESIGN GRAPHS IN MICROSOFT EXCEL (TM) 2007. JOURNAL OF APPLIED BEHAVIOR ANALYSIS. 2009;42(2):277-93.
237. Hopman WM, Towheed T, Anastassiades T, Tenenhouse A, Poliquin S, Berger C, et al. Canadian normative data for the SF-36 health survey. Canadian Multicentre Osteoporosis Study Research Group. CMAJ. 2000;163(3):265-71.
238. Potvin MM, editor Return To Duty Program for Ill and Injured CAF Personnel. Military and Veteran Health Research Forum 2015; 2015 24 November; Quebec City, QC: Quebec City, 2015.
239. Hauret KG, Shippey DL, Knapik JJ. The physical training and rehabilitation program: duration of rehabilitation and final outcome of injuries in basic combat training. Military Medicine. 2001;166(9):820-6.
240. Hawes R, editor Forum presentation: Sick leave in the CAF: Health risk correlates, operational impact and economic cost. Military Health and Veteran Health Research Forum; 2015 23-25 November; Quebec City.
241. Booth-Kewley S, Schmied EA, Highfill-McRoy RM, Sander TC, Blivin SJ, Garland CF. A prospective study of factors affecting recovery from musculoskeletal injuries. J Occup Rehabil. 2014;24(2):287-96.
242. Dogra S, Clarke J, Roy J, Fowles J. BMI-specific waist circumference is better than skinfolds for health-risk determination in the general population. Applied Physiology, Nutrition & Metabolism. 2015;40(2):134-41.
243. Meerman R, Brown AJ. When somebody loses weight, where does the fat go?2014 2014-12-16 13:51:20.
244. Hayes SC. Single case experimental design and empirical clinical practice. Journal of Consulting & Clinical Psychology. 1981;49:193-211.
245. Schultz IZ, Stowell AW, Feuerstein M, Gatchel RJ. Models of return to work for musculoskeletal disorders. J Occup Rehabil. 2007;17(2):327-52.
246. Loisel P, Buchbinder R, Hazard R, Keller R, Scheel I, van Tulder M, et al. Prevention of work disability due to musculoskeletal disorders: the challenge of implementing evidence. Journal of Occupational Rehabilitation. 2005;15(4):507-24.
247. Guzmán J, Esmail R, Karjalainen K, Malmivaara A, Irvin E, Bombardier C. Multidisciplinary Rehabilitation For Chronic Low Back Pain: Systematic Review. BMJ: British Medical Journal. 2001(7301):1511.
248. Kelly TK. An Assessment of the Army's Tactical Human Optimization, Rapid Rehabilitation and Reconditioning Program. 2013-01., 2013.
249. Monahan S, Kratochwill T, Lipscomb S, Society for Research on Educational E. What Works Clearinghouse (WWC) Standards for Evaluating Single Case Designs (SCDs). Society for Research on Educational Effectiveness, 2011.
250. Satake E, Jagaroo V, Maxwell DL. Handbook of statistical methods : single subject design. San Diego: Plural Pub.; 2008. ix, 162 p. p.
251. Busse RT, Kratochwill TR. Meta-analysis for single-case consultation outcomes: Applications to research and practice. Journal of School Psychology. 1995;33(4):269.
252. Hitchcock JH, Horner RH, Kratochwill TR, Levin JR, Odom SL, Rindskopf DM, et al. The What Works Clearinghouse Single-Case Design Pilot Standards: Who Will Guard the Guards? Remedial & Special Education. 2014;35(3):145-52.
253. Sachs BL, David JA, Olimpio D, Scala AD, Lacroix M. Spinal rehabilitation by work tolerance based on objective physical capacity assessment of dysfunction. A prospective study with control subjects and twelve-month review. Spine. 1990;15(12):1325-32.
254. Wang YC, Hart DL, Stratford PW, Mioduski JE. Baseline dependency of minimal clinically important improvement. Phys Ther. 2011;91(5):675-88.
255. Gross A, Forget M, St George K, Fraser MMH, Graham N, Perry L, et al. Patient education for neck pain. The Cochrane database of systematic reviews. 2012;3:CD005106.
256. Gatchel RJ, Mayer TG. Testing minimal clinically important difference: consensus or conundrum? The spine journal : official journal of the North American Spine Society. 2010;10(4):321-7.
257. Gatchel RJ, Mayer TG, Choi Y, Chou R. Validation of a consensus-based minimal clinically important difference (MCID) threshold using an objective functional external anchor. The spine journal : official journal of the North American Spine Society. 2013;13(8):889-93.
258. Ringash J, O'Sullivan B, Bezjak A, Redelmeier DA. Interpreting clinically significant changes in patient-reported outcomes. Cancer. 2007;110(1):196-202.
259. Thelen MD, Koppenhaver SL, Hoppes CW, Shutt C, Musen JL, Williams MK. Reliability of a Novel Return to Duty Screening Tool for Military Clinicians. US Army Med Dep J. 2015:14-23.
260. Wolery M, Billingsley FF. The application of Revusky's Rn test to slope and level changes. Behavioral Assessment. 1982;4(1):93-103.
261. Kroll T, Morris J. Challenges and opportunities in using mixed method designs in rehabilitation research. Archives of Physical Medicine & Rehabilitation. 2009;90(11):S11-6.
262. Ross R, Berentzen T, Bradshaw AJ, Janssen I, Kahn HS, Katzmarzyk PT, et al. Does the relationship between waist

circumference, morbidity and mortality depend on measurement protocol for waist circumference? Obesity Reviews: An Official Journal Of The International Association For The Study Of Obesity. 2008;9(4):312-25.

263. Romeiser Logan L, Hickman RR, Harris SR, Heriza CB. Single-subject research design: recommendations for levels of evidence and quality rating. Developmental Medicine & Child Neurology. 2008;50(2):99-103.

21. APPENDICIES

Appendix 1: Need analysis of the Fitness for Operational Readiness of the CAF Employment

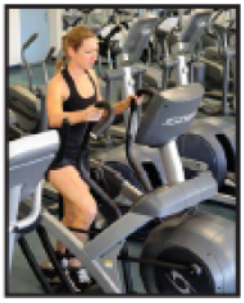


Appendix 2 Primary movements found in the Fitness for Operational Readiness of the CAF Employment

1. Squat (found in sandbag lift and drag)
2. Side step (found in sandbag lift)
3. Lunge (found in intermittent loaded shuttles)
4. Walk-run (found in intermittent loaded shuttles)
5. Sprints (found in 20 meters rushes)
6. Backwards drag (found in sandbag drag)
7. Get up (found in 20 meters rushes)
8. Drop/slam (found in sandbag lift, intermittent loaded shuttles and sandbag drag)
9. Upper extremity push or press (found in backward drag and 20 meters rushes)
10. Isometric hold (found in backward drag)

Appendix 3: Return to Duty intervention' activation

Return to Duty Exercise Program - Activation



5 Minutes of elliptical machine, moderate effort

1

10 X Thoracic mobility lying on foam roller, switch side after 5

2

2 X Arm swings while walking 20m

3

2 X "A drills" 20m (dynamic hip and knee flexion)

4

2 X "B drills" 20m (dynamic kick forward)

5

2 X "C drills" 20m (dynamic hip extension)

Design by Frederic Rancourt

1/2

Return to Duty Exercise Program - Activation (cont.)

6

2 X "D drills" 20m
(dynamic kick back)

7

8 X McGill airplane, switch side after 4 (single leg deadlift)

8

4 X Stretch deep squat

9

8 X Side step with mini squat, both sides

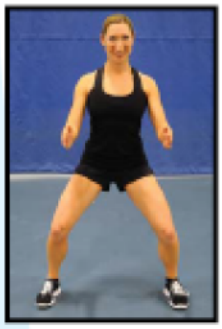
10

8 X Lunge to reverse lunge, switch side after 4

Appendix 4: Return to Duty intervention' physical training

Return to Duty Exercise Program 1

11



30 X Body weight deep squats, fingers pointing down and touching the ground

12

30 X Side steps to the right with mini squat, side steps to the left with mini squat

13

30 X Dynamic wall push ups, wide stance heels on ground

14

30 X 5kg Standing crunch medball slam (rebound, no pick up)

15

10 X Forward lunge, swith side after 5

After exercise #14, take 2-3 minutes rest

Design by Frederic Rancourt

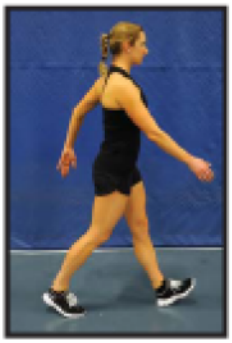
1/2

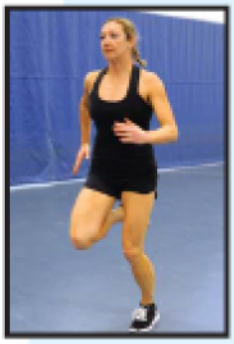
Return to Duty Exercise Program 1

16

10 X 5kg Medball wall throw, facing forward
In a split stance, switch leg after 5 reps

17

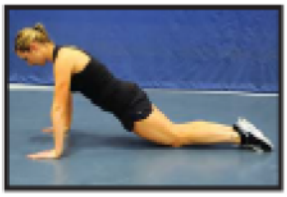




5 X Walk-slow Jog:
2 X 20m walk back and forth,
2 X 20m slow jog back and forth

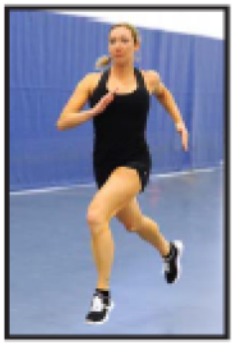
After exercise #17, take 2-3 minutes rest

18



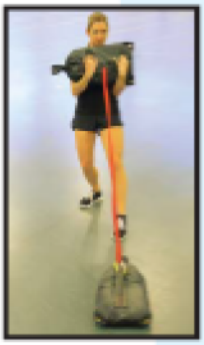
8 X Knee push up, starting in a push up position

19



8 X 10m Slow Jog small steps on mid
foot, stop every 10m and start again

20



1 X Backward sandbag drag
20kg over 20m
(holding a 20kg sandbag)

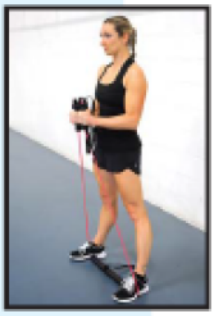
After exercise #19, take 2-3 minutes rest

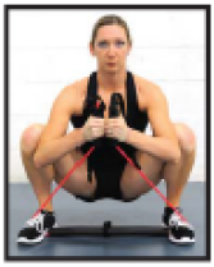
Design by Frederic Rancourt

2/2

Return to Duty Exercise Program 2

21





30 X Cook band deep squat, hammer curl hand position

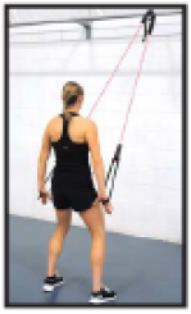
22

15 X Cook band side steps to the right with mini squat,
15 X Cook bands side steps to the left with mini squat

23

30 X Cook band bilateral chest press, wide stance, open hands

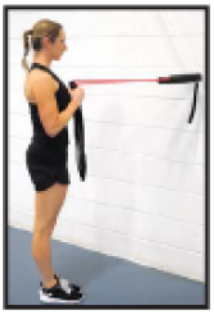
24



30 X Cook band high pull down, wide stance, open hands

After exercise #24, take 2-3 minutes rest

25



10 X Cook band reverse lunges, closed fists on handles, switch side after 5

Design by Frederic Rancourt

1/2

Return to Duty Exercise Program 2

26

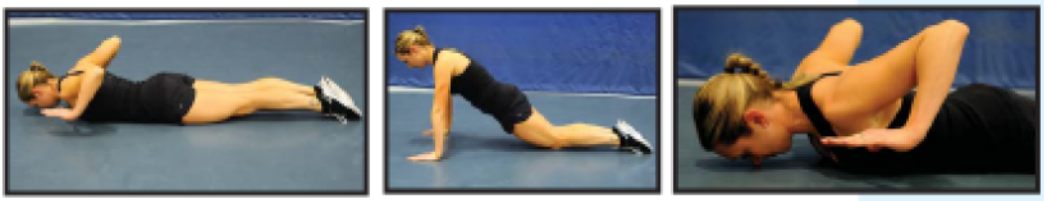
3 X 30s Cook band isometric hold, low row wide stance, hammer curl hand position

27

5 X Walk-Jog:
2 X 20m walk back and forth,
2 X 20m jog back and forth

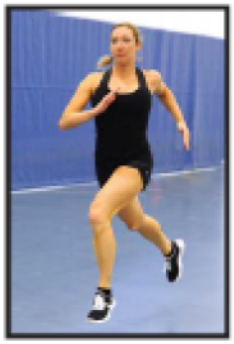
After exercise #27, take 2-3 minutes rest

28



8 X Kneeling dynamic hand release push up, starting in a prone position

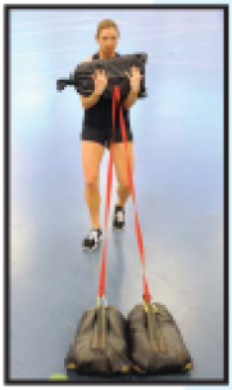
29



8 X 10m Jog small steps on mid foot, stop every 10m and start again

After exercise #29, take 2-3 minutes rest

30



1 X Backward sandbag drag 40kg over 20m (holding a 20kg sandbag)

Design by Frederic Rancourt

2/2

Return to Duty Exercise Program 3

31


30 X Cable squat on a step, 20kg hammer curl
Isometric hold (rope attachment)

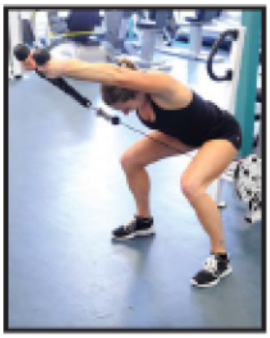
32


15 X Side steps to the right with
5kg slam ball throw,
15 X side steps to the left with with
5kg slam ball throw

33


30 X Cable bilateral chest press, wide stance
10kg each side (foam handle attachment)

34

30 X Cable pull through, wide stance
20kg (rope attachment)

After exercise #34, take 2-3 minutes rest

35


10 X Cable reverse lunges each side
20kg, switch side after 5 (rope attachment)

Design by Frederic Rancourt

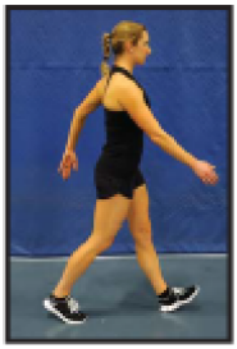
1/2

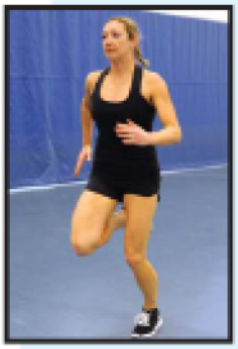
Return to Duty Exercise Program 3

36

8 X Hand release full push up, starting in a push-up position

37

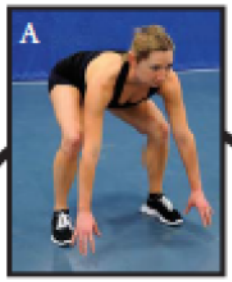


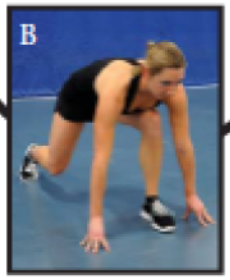


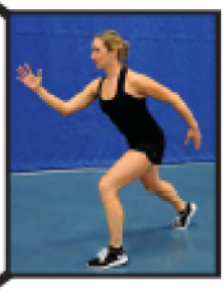
5 X Walk-run:
2 X 20m walk back and forth,
2 X 20m run back and forth

After exercise #37, take 2-3 minutes rest

38

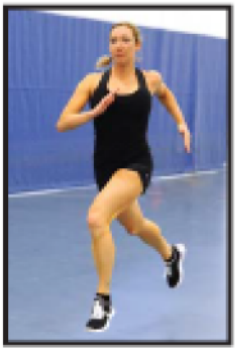






8 X Hand release get up (option A burpee or option B sprinter start, choose preferred technique)

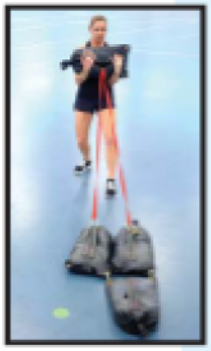
39



8 X 10m Run small steps on mid foot, stop every 10m and start again

After exercise #39, take 2-3 minutes rest

40



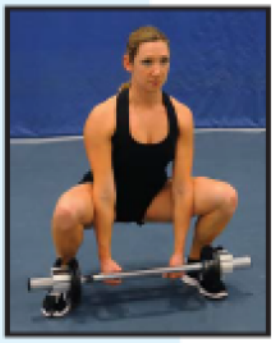
1 X Sandbag drag 60kg over 20m
(holding a 20kg sandbag)

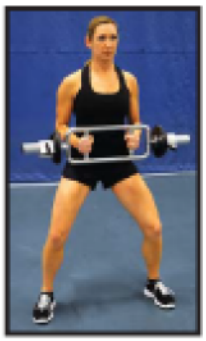
Design by Frederic Rancourt

2/2

Return to Duty Exercise Program 4

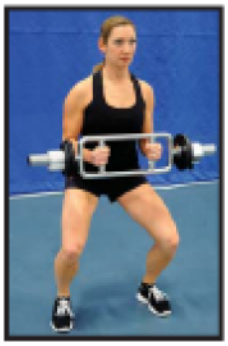
41





30 X Deep squat, with 20kg triceps bar

42

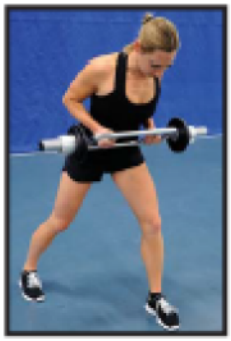


15 X Side steps to the right with mini squat, carying a 20kg triceps bar
15 X Side steps to the left with mini squat, carying a 20kg triceps bar

43

30 X Biceps curls,
wide stance 20kg each side

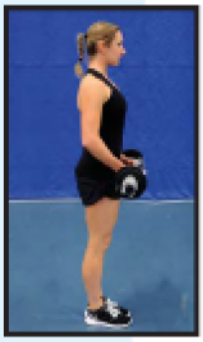
44

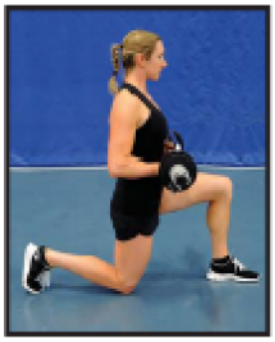


3 X 30s 20kg Triceps bar isometric hold,
low row, off-set stance with forward trunk

After exercise #44, take 2-3 minutes rest

45





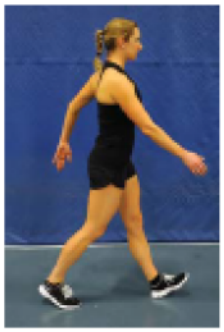
10 X Reverse lunge,
carrying 20kg triceps bar, both sides

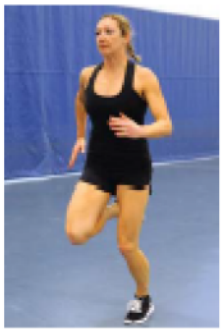
46

8 X Hand release push up starting in a prone position

Return to Duty Exercise Program 4

47

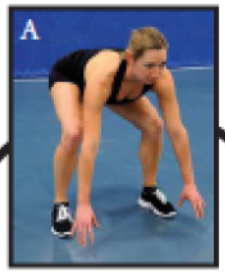


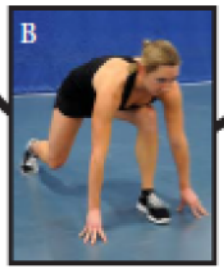


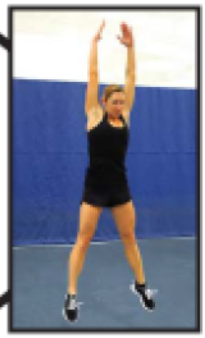
5 X Walk-sprint:
2 X 20m walk back and forth,
2 X 20m sprint back and forth

After exercise #47, take 2-3 minutes rest

48





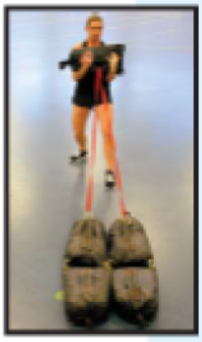


8 X Hand release get up with jump (option A burpee or option B sprinter start, choose preferred technique)

49

8 X 10m Sprint, small steps on mid foot, stop every 10m and start again

50



1 X Sandbag drag 80kg over 20m (holding a 20kg sandbag)

After exercise #49, take 2-3 minutes rest

Design by Frederic Rancourt

2/2

Appendix 5: Confirmation Letter

Primary Care Nurse
Care Delivery Unit

RANK AND NAME OF THE PARTICIPANT
SERVICE NUMBER

RANK AND NAME has been selected for the Return to Duty program.

Return to Duty is a 10-weeks group intervention delivered by the physical rehabilitation clinic, Personnel Support Program and Health Promotion. The goal is to assist the member to return to work in a Canadian Armed Forces unit. Return To Duty encompasses supervised physical exercise, cognition, health education and the FORCE attempt.

The full program (including testing) runs from [date], and the projected FORCE attempt is [date]. As a follow up, an entry into CFHIS as CF2016 (Progress Notes) will be completed after [date].

We look forward in providing final results and recommendations,

The return to Duty team
(Point of contact: primary investigator)

Appendix 6: Standardized progress note

PROTECTED B

Patient:

Return to Duty Intervention (Physio, OT, PSP, Health Promotion) **Document Date**

In case of completion:

[Fill participant' name] has been participating in the Return to Duty program since [fill date].

Return to Duty is a 10-week group intervention delivered by physical rehabilitation, Personnel Support Program and health promotion that assist the member to return to work in a Canadian Armed Force unit. Return to Duty encompasses supervised physical exercises, cognition, health education and the completion of the FORCE.

The Return to Duty team agreed that all tools were provided for [fill participant' name] to return to full fit duties. [Participant' name] has successful completed the program. [Fill participant' name] should be reassessed by Medical Doctor to determine if current medical category & Medical Employment Limitations need to be reviewed.

In case of dropout:

[Fill participant' name] has been participating in the Return to Duty program since [fill date].

Return to Duty is a 10-week group intervention delivered by physical rehabilitation, Personnel Support Program and health promotion that assist the member to return to work in a Canadian Armed Force unit. Return To Duty encompasses supervised physical exercises, cognition, health education and the completion of the FORCE.

The Return to Duty team agreed that all tools were provided for [Participant' name] to return to full fit duties. [Participant' name] has chosen not to complete the course. Further follow up may be advisable.

Signed by: ORIGINATOR, date

Appendix 7: Informed consent

UNIVERSITY OF ALBERTA

Informed Consent

Title of project:

Return To Duty: **Exploring the physical function, health status and return to work of casualties in the Canadian Armed Forces using a multiple baseline design**

Principal investigator:	Dr Jacqueline Hebert, MD, FRCPC	Phone number: 780- 735-8218
Co-investigator:	Sebastien Perigny-Lajoie, M.Sc.RS (candidate)	Phone number: 780-218-1948

To be completed by the research subject:

	Yes	No
Do you understand that you have been asked to be in a research study?	☐	☐
Have you received and read the Information Sheet?	☐	☐
Do you understand the benefits and risks involved in taking part in this research study?	☐	☐
Have you had an opportunity to ask questions and discuss this study?	☐	☐
Do you understand that you are free to withdraw from the study at any time without having to provide a reason and without affecting your status in the military?	☐	☐
Has the topic of confidentiality been explained to you?	☐	☐
Do you understand who will have access to your research results?	☐	☐

Who explained this study to you?_____

I agree to take part in this study (please circle): YES NO

Printed name of research subject:

_____

Signature of research subject: _____

Date:_____

I believe that the person signing this form understands what is involved in the study and voluntary agrees to participate.

Signature of co-investigator:_____Date: _____

THE INFORMATION SHEET MUST BE ATTACHED TO THIS CONSENT FORM AN A COPY GIVEN TO THE RESEARCH SUBJECT

Version 2, page 1/1

The information sheet must be attached to this consent form and a copy given to the research participant.

Appendix 8: Information letter

UNIVERSITY OF ALBERTA

Information Letter

Study: *Return To Duty:* Exploring the physical function, health status and return to work of casualties in the Canadian Armed Forces using a multiple baseline design

Principal investigator

Dr. Jacqueline Hebert, FRCPC Faculty of Rehabilitation Medicine, U of A

Co-investigator

Sebastien Perigny-Lajoie, M.Sc.RS (candidate), Faculty of Rehabilitation Medicine, U of A

Contact Information

Sebastien Perigny-Lajoie at perignyl@ualberta.ca or 780-218-1948. Alternatively, Dr. Jacqueline Hebert at: 780-735-8218.

Background

You are being asked to be in this study because you have an injury/illness that could interfere with your work and you are considering returning "full-fit" to a unit. You have been identified and cleared by the CoC and Health Services for this 10-week program. As of right now, there is no organized Return To Work program for the Canadian Armed Forces (CAF) that includes exercise and group education. Before you make a decision, the study coordinator will go over this form with you. You are encouraged to ask questions if you feel anything needs to be made clearer. You will be given a copy of this form. Many specialists, including PSP were assembled to design and deliver this program under the name Return to Duty (RTD).

Purpose

You are being asked to participate in this study, which measures the physical function and health outcomes of the program that potentially lead to a successful Return To Work in a CAF unit. The goal of RTD is to assist the casualties with their return to duty in the CAF. This 10-week intervention includes group exercise and education, as well as 2 individual exercise sessions per week.

If you agree to enter the study, you will be asked to sign this consent form, and agree to the following:

a) You will be given a study number, to keep the information confidential

b) You will undergo repeated testing (simple physical tests and short forms). Tests are most likely every Tuesdays and Thursdays in the morning at the PSP gym, the full measures take approximately 20 min. An exact schedule will be provided to you once we have exact numbers. You will receive a minimum of 9 to a maximum of 14 testing appointments. Tests used are: 2 leg tests, 1 handgrip test and 2 body fat (waist circumference and skinfolds), 1 short form about Return To Work, 1 short form about personal barriers, and 1 short form about mental health. Also, 2 forms will need to be filled out only twice: 1 form containing 36 questions about general health and 1 form about mental health (45 questions),

c) You will need to attend the program, most likely every Thursday at 09:00 for exercise and 10:30 for the group classes, which will be done at 11:30. An exact schedule will be provided to you once we have exact numbers. The expectation is that you repeat the workouts twice per week at the PSP gym Field House.

d) During the intervention, you will need to have repeated testing on Tuesday mornings at the PSP gym on week 3, 6 and 9. At those times, your exercises will change as well. Every Thursday, you will have a PSP trainer direct you with the exercises.

e) After the 10th week of the program you will challenge the FORCE test and be retested on the repeated measures 3 times over 2 weeks (Tuesdays-Thursdays-Tuesdays morning).

f) You will be required to log ALL physical activity in the logbook that is provided to you. The logbook remains the property of the PSP trainer. Right after every workout, you will log all your exercises in your logbook. This should take 5 minutes each time. The PSP trainer will review the logbook with you once a week.

g) At the end of the program after 10 weeks, a note will be sent to your clinician to report on your completion of the program.

If you choose not to do the study, we will provide you with the exercise program and the group education material. You can choose to do the same thing on your own and PSP will be available by 1:1 appointments if you need help.

Benefits/Risks (or discomfort)

Physical activity always carries a risk of injuries to the soft tissues of the body (muscles, ligaments, tendons) however; none of the participants from the 2 previous groups sustained an injury during this program. You will have access to a physiotherapist or doctor if required. It is not possible to know all of the risks that may happen in a study, but the researchers have taken all reasonable safeguards to minimize any known risks to a study participant. The potential benefit of this study is improving your health and physical function to allow you to return to work in a CAF unit, meaning career retention. It is also possible that this research will not change anything for you. This study may help other ill and injured military personnel in the future.

Voluntary Participation

Your participation is completely voluntary. If at any time you decide to withdraw you are free to do so. There will be no consequences with your Chain of Command or with the medical system. If you decide to withdraw, we will not collect any further information, but will use the information that we already have (up to the withdrawal). If you withdraw we will ask you for your logbook. On the questionnaires you do not have to answer any questions that you are not comfortable with.

Confidentiality

During the study we will be collecting data about you. We will do everything we can to make sure that this data is kept private. No data relating to this study that includes your name will be released outside of the co-investigator's office or published by the investigators. However, we will make every legal effort to make sure that your information is kept private. All documentation gathered will be handled only with study numbers (no names) and all paperwork will be kept in an individual opaque folder in the investigator' locked file cabinet. Your name will not be disclosed outside the research clinic except where a code of ethics or the law requires. Any reports published as results of this study will not identify you by name. The data will be secured and locked for 5 years. The data gathered for this study may be looked at again. In the future to help us answer other study questions. If so, an ethics board will first review the study to ensure that the data are used ethically.

In Case of Injury

After the group classes you will have access to a physiotherapist or a doctor. As usual, just check in at sick parade is needed.

In Case of Emotional Distress

If you feel emotionally stressed about anything related to the study, please contact the co-investigator right away. If you feel it is an issue that you do not want to speak to the co-investigator about, please contact a doctor from any base/wing phone by dialing the operator at 0. If the issue deals with anything other than the research process, please contact the peer support group coordinator or the duty padre at again by dialing 0 from any base/wing phone.

In Case of Research Participant's Right

For questions related to one's right as a research participant, please contact the U of A Health Ethics Board at 780-492-0302.

Appendix 9: Physical Activity Readiness Questionnaire+

CSEP approved Sept 12 2011 version

PAR-Q+

The Physical Activity Readiness Questionnaire for Everyone

Regular physical activity is fun and healthy, and more people should become more physically active every day of the week. Being more physically active is very safe for MOST people. This questionnaire will tell you whether it is necessary for you to seek further advice from your doctor OR a qualified exercise professional before becoming more physically active.

SECTION 1 - GENERAL HEALTH

	Please read the 7 questions below carefully and answer each one honestly: check YES or NO.	YES	NO
1.	Has your doctor ever said that you have a heart condition OR high blood pressure?	☐	☐
2.	Do you feel pain in your chest at rest, during your daily activities of living, OR when you do physical activity?	☐	☐
3.	Do you lose balance because of dizziness OR have you lost consciousness in the last 12 months? Please answer NO if your dizziness was associated with over-breathing (including during vigorous exercise).	☐	☐
4.	Have you ever been diagnosed with another chronic medical condition (other than heart disease or high blood pressure)?	☐	☐
5.	Are you currently taking prescribed medications for a chronic medical condition?	☐	☐
6.	Do you have a bone or joint problem that could be made worse by becoming more physically active? Please answer NO if you had a joint problem in the past, but it does not limit your current ability to be physically active. For example, knee, ankle, shoulder or other.	☐	☐
7.	Has your doctor ever said that you should only do medically supervised physical activity?	☐	☐

If you answered NO to all of the questions above, you are cleared for physical activity.

Go to Section 3 to sign the form. You do not need to complete Section 2.

- Start becoming much more physically active – start slowly and build up gradually.
- Follow the Canadian Physical Activity Guidelines for your age (www.csep.ca/guidelines).
- You may take part in a health and fitness appraisal.
- If you have any further questions, contact a qualified exercise professional such as a CSEP Certified Exercise Physiologist® (CSEP-CEP) or CSEP Certified Personal Trainer® (CSEP-CPT).
- If you are over the age of 45 yrs. and NOT accustomed to regular vigorous physical activity, please consult a qualified exercise professional (CSEP-CEP) before engaging in maximal effort exercise.

If you answered YES to one or more of the questions above, please GO TO SECTION 2.

Delay becoming more active if:

- You are not feeling well because of a temporary illness such as a cold or fever – wait until you feel better
- You are pregnant – talk to your health care practitioner, your physician, a qualified exercise professional, and/or complete the PARmed-X for Pregnancy before becoming more physically active OR
- Your health changes – please answer the questions on Section 2 of this document and/or talk to your doctor or qualified exercise professional (CSEP-CEP or CSEP-CPT) before continuing with any physical activity programme.

CSEP | SCPE THE GOLD STANDARD IN EXERCISE SCIENCE AND PERSONAL TRAINING

SECTION 2 - CHRONIC MEDICAL CONDITIONS

Please read the questions below carefully and answer each one honestly: check YES or NO.			YES	NO
1.	Do you have Arthritis, Osteoporosis, or Back Problems?		☐ If yes, answer questions 1a-1c	☐ If no, go to question 2
	1a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)	☐	☐
	1b.	Do you have joint problems causing pain, a recent fracture or fracture caused by osteoporosis or cancer, displaced vertebra (e.g., spondylolisthesis), and/ or spondylolysis/pars defect (a crack in the bony ring on the back of the spinal column)?	☐	☐
	1c.	Have you had steroid injections or taken steroid tablets regularly for more than 3 months?	☐	☐
2.	Do you have Cancer of any kind?		☐ If yes, answer questions 2a-2b	☐ If no, go to question 3
	2a.	Does your cancer diagnosis include any of the following types: lung/bronchogenic, multiple myeloma (cancer of plasma cells), head, and neck?	☐	☐
	2b.	Are you currently receiving cancer therapy (such as chemotherapy or radiotherapy)?	☐	☐
3.	Do you have Heart Disease or Cardiovascular Disease? This includes Coronary Artery Disease, High Blood Pressure, Heart Failure, Diagnosed Abnormality of Heart Rhythm		☐ If yes, answer questions 3a-3e	☐ If no, go to question 4
	3a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)	☐	☐
	3b.	Do you have an irregular heart beat that requires medical management? (e.g. atrial brillation, premature ventricular contraction)	☐	☐
	3c.	Do you have chronic heart failure?	☐	☐
	3d.	Do you have a resting blood pressure equal to or greater than 160/90 mmHg with or without medication? (Answer YES if you do not know your resting blood pressure)	☐	☐
	3e.	Do you have diagnosed coronary artery (cardiovascular) disease and have not participated in regular physical activity in the last 2 months?	☐	☐
4.	Do you have any Metabolic Conditions? This includes Type 1 Diabetes, Type 2 Diabetes, Pre-Diabetes		☐ If yes, answer questions 4a-4c	☐ If no, go to question 5
	4a.	Is your blood sugar often above 13.0 mmol/L? (Answer YES if you are not sure)	☐	☐
	4b.	Do you have any signs or symptoms of diabetes complications such as heart or vascular disease and/or complications affecting your eyes, kidneys, and the sensation in your toes and feet?	☐	☐
	4c.	Do you have other metabolic conditions (such as thyroid disorders, pregnancy-related diabetes, chronic kidney disease, liver problems)?	☐	☐
5.	Do you have any Mental Health Problems or Learning Difficulties? This includes Alzheimer's, Dementia, Depression, Anxiety Disorder, Eating Disorder, Psychotic Disorder, Intellectual Disability, Down Syndrome)		☐ If yes, answer questions 5a-5b	☐ If no, go to question 6
	5a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)	☐	☐
	5b.	Do you also have back problems affecting nerves or muscles?	☐	☐

Please read the questions below carefully and answer each one honestly: check YES or NO.			YES	NO
6.	Do you have a Respiratory Disease? This includes Chronic Obstructive Pulmonary Disease, Asthma, Pulmonary High Blood Pressure		☐ If yes, answer questions 6a-6d	☐ If no, go to question 7
	6a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)	☐	☐
	6b.	Has your doctor ever said your blood oxygen level is low at rest or during exercise and/or that you require supplemental oxygen therapy?	☐	☐
	6c.	If asthmatic, do you currently have symptoms of chest tightness, wheezing, laboured breathing, consistent cough (more than 2 days/week), or have you used your rescue medication more than twice in the last week?	☐	☐
	6d.	Has your doctor ever said you have high blood pressure in the blood vessels of your lungs?	☐	☐
7.	Do you have a Spinal Cord Injury? This includes Tetraplegia and Paraplegia		☐ If yes, answer questions 7a-7c	☐ If no, go to question 8
	7a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)	☐	☐
	7b.	Do you commonly exhibit low resting blood pressure significant enough to cause dizziness, light-headedness, and/or fainting?	☐	☐
	7c.	Has your physician indicated that you exhibit sudden bouts of high blood pressure (known as Autonomic Dysreflexia)?	☐	☐
8.	Have you had a Stroke? This includes Transient Ischemic Attack (TIA) or Cerebrovascular Event		☐ If yes, answer questions 8a-c	☐ If no, go to question 9
	8a.	Do you have difficulty controlling your condition with medications or other physician-prescribed therapies? (Answer NO if you are not currently taking medications or other treatments)	☐	☐
	8b.	Do you have any impairment in walking or mobility?	☐	☐
	8c.	Have you experienced a stroke or impairment in nerves or muscles in the past 6 months?	☐	☐
9.	Do you have any other medical condition not listed above or do you live with two chronic conditions?		☐ If yes, answer questions 9a-c	☐ If no, read the advice on page 4
	9a.	Have you experienced a blackout, fainted, or lost consciousness as a result of a head injury within the last 12 months OR have you had a diagnosed concussion within the last 12 months?	☐	☐
	9b.	Do you have a medical condition that is not listed (such as epilepsy, neurological conditions, kidney problems)?	☐	☐
	9c.	Do you currently live with two chronic conditions?	☐	☐

Please proceed to Page 4 for recommendations for your current medical condition and sign this document.

PAR-Q+

If you answered NO to all of the follow-up questions about your medical condition, you are ready to become more physically active:

- It is advised that you consult a qualified exercise professional (e.g., a CSEP-CEP or CSEP-CPT) to help you develop a safe and effective physical activity plan to meet your health needs.
- You are encouraged to start slowly and build up gradually – 20-60 min. of low- to moderate-intensity exercise, 3-5 days per week including aerobic and muscle strengthening exercises.
- As you progress, you should aim to accumulate 150 minutes or more of moderate-intensity physical activity per week.
- If you are over the age of 45 yrs. and NOT accustomed to regular vigorous physical activity, please consult a qualified exercise professional (CSEP-CEP) before engaging in maximal effort exercise.

If you answered YES to one or more of the follow-up questions about your medical condition:

- You should seek further information from a licensed health care professional before becoming more physically active or engaging in a fitness appraisal and/or visit a or qualified exercise professional (CSEP-CEP) for further information.

Delay becoming more active if:

- You are not feeling well because of a temporary illness such as a cold or fever – wait until you feel better
- You are pregnant - talk to your health care practitioner, your physician, a qualified exercise profesional, and/or complete the PARmed-X for Pregnancy before becoming more physically active OR
- Your health changes - please talk to your doctor or qualified exercise professional (CSEP-CEP) before continuing with any physical activity programme.

SECTION 3 - DECLARATION

- You are encouraged to photocopy the PAR-Q+. You must use the entire questionnaire and NO changes are permitted.
- The Canadian Society for Exercise Physiology, the PAR-Q+ Collaboration, and their agents assume no liability for persons who undertake physical activity. If in doubt after completing the questionnaire, consult your doctor prior to physical activity.
- If you are less than the legal age required for consent or require the assent of a care provider, your parent, guardian or care provider must also sign this form.
- Please read and sign the declaration below:

I, the undersigned, have read, understood to my full satisfaction and completed this questionnaire. I acknowledge that this physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if my condition changes. I also acknowledge that a Trustee (such as my employer, community/fitness centre, health care provider, or other designate) may retain a copy of this form for their records. In these instances, the Trustee will be required to adhere to local, national, and international guidelines regarding the storage of personal health information ensuring that they maintain the privacy of the information and do not misuse or wrongfully disclose such information.

NAME _____ DATE _____

SIGNATURE _____ WITNESS _____

SIGNATURE OF PARENT/GUARDIAN/CARE PROVIDER _____

For more information, please contact:
Canadian Society for Exercise Physiology
www.csep.ca

KEY REFERENCES

1. Jamnik VJ, Warburton DER, Makarski J, McKenzie DC, Shephard RJ, Stone J, and Gledhill N. Enhancing the cectiveness of clearance for physical activity participation: background and overall process. APNM 36(S1):S3-S13, 2011.

2. Warburton DER, Gledhill N, Jamnik VK, Bredin SSD, McKenzie DC, Stone J, Charlesworth S, and Shephard RJ. Evidence-based risk assessment and recommendations for physical activity clearance; Consensus Document. APNM 36(S1):S266-s298, 2011.

The PAR-Q+ was created using the evidence-based AGREE process (1) by the PAR-Q+Collaboration chaired by Dr. Darren E. R. Warburton with Dr. Norman Gledhill, Dr. Veronica Jamnik, and Dr. Donald C. McKenzie (2). Production of this document has been made possible through financial contributions from the Public Health Agency of Canada and the BC Ministry of Health Services. The views expressed herein do not necessarily represent the views of the Public Health Agency of Canada or BC Ministry of Health Services.

CSEP approved Sept 12 2011 version

Appendix 10: Instructions read out loud for repeated measures

1) "For the 4 Square Step Test, four 1-inch thick sticks are placed on the floor, making the shape of a + sign. Participant starts with both feet at the lower-left quadrant and must step into the 4 boxes clockwise with 2 feet in every box and immediately into the 4 boxes counterclockwise back to the start position, as fast as possible. Both feet must touch all quadrants. Participant will perform 1 practice, followed by 4 trials. Breaks in between trials are as required only, up to 60 seconds break in between trials. Participant must remain facing forward (no trunk rotations). Are you ready, do you have any questions?"

2) "In the 5 Times Sit-to-Stand Test, the participant starts in seated position on a 43 centimeters-high chair with their arms crossed at their chest and asked to fully stand and sit down again, 5 times as fast as possible. Feet are hips-with apart and participant is not touching backrest. Participant complete 2 trials with 60 seconds rest in between. Are you ready, do you have any questions?"

3) "For the Handgrip Strength the participant will be asked to perform a maximal hand contraction for every sound (1 second duration) at every 1.5 seconds for 20 repetitions. Measurement will be taken with the right side first, and the handle is always at the 2nd notch. Arm is flat to the body (not abducted) and feet are together. Are you ready, do you have any questions?"

4) "Body fat is taken with the sum of the 3 sites will be taken on the right side and always in the same order, twice. Participant' feet are together. Are you ready, do you have any questions?"

5) "Waist Circumference is measured with the protocol: Height of Iliac Crest. Measurement will be taken with a factory-new Gullick anthropometric tape. The waist circumference will be measured twice and repeated a 3rd time if they differ more than 1 centimeter. Are you ready, do you have any questions?

6) PSFS and WAI' instructions are on the sheet (respectively Appendix 12 and 13).

Appendix 11: Height of Iliac Crest waist circumference testing protocol (from Bernritter 2001)

TABLE 1 Procedure for Obtaining Waist Circumference Measurements Using the Height of Illiac Crest Method

Patient preparation

- NPO ≥ 4 hr prior to measurement
- Void bowel and bladder immediately prior to measurement
- Wear standardized garments that do not bind or bunch the skin or subcutaneous adipose tissue.

Patient positioning

Stand in natural upright position, feet together, weight evenly distributed on both feet

Arms are crossed over the chest with hands placed in the opposite axillae

Head is held up with eyes level and looking straight ahead

Stand barefoot on a hard flat surface, not on carpeting or floor pad

Breathing

Measurement is made during held exhalation

Measuring tape

Constant tension, circumferential measuring tape

Measurement is made while pressing the tension release button

Anatomical location/procedure

Palpate the superior-most point of the iliac crest (IC) on the right side of the body

Mark the patient's skin at that point at the midaxillary line

While maintaining the patient's position, hold one end of a tape measure tape to floor

Stretch tape up along midline of right leg to IC mark on waist ensuring tape is not twisted or kinked and remains vertical

Record the distance from the floor to the bottom of the marked line on waist to the nearest millimeter.

Use this distance to find the HIC for this patient during all subsequent WC measurements. Do not palpate to find the IC for tape placement but instead measure from floor to previously recorded HIC.

Align top of tape with bottom of HIC mark to obtain measurements

Appendix 12: Patient-Specific Functional Scale

The Patient-Specific Functional Scale

This useful questionnaire can be used to quantify activity limitation and measure functional outcome for patients with any orthopaedic condition.

Clinician to read and fill in below: Complete at the end of the history and prior to physical examination.

Initial Assessment:

I am going to ask you to identify up to three important activities that you are unable to do or are having difficulty with as a result of your _____ problem. Today, are there any activities that you are unable to do or having difficulty with because of your _____ problem? (Clinician: show scale to patient and have the patient rate each activity).

Follow-up Assessments:

When I assessed you on (state previous assessment date), you told me that you had difficulty with (read all activities from list at a time). Today, do you still have difficulty with: (read and have patient score each item in the list)?

Patient-specific activity scoring scheme (Point to one number):

0 1 2 3 4 5 6 7 8 9 10

Unable to perform activity

Able to perform activity at the same level as before injury or problem

(Date and Score)

Activity	Initial					
1.						
2.						
3.						
4.						
5.						
Additional						
Additional						

Total score = sum of the activity scores/number of activities
Minimum detectable change (90%CI) for average score = 2 points
Minimum detectable change (90%CI) for single activity score = 3 points

PSFS developed by: Stratford, P., Gill, C., Westaway, M., & Binkley, J. (1995). Assessing disability and change on individual patients: a report of a patient specific measure. Physiotherapy Canada, 47, 258-263.

Reproduced with the permission of the authors.

Appendix 13: Work Ability Index (abridged)

Work Ability Index

1. Current work ability compared with the lifetime best

Assume that your work ability at its best has a value of 10 points.
How many points would you give your current work ability?
(0 means that you cannot currently work at all)

completely unable to work	0	1	2	3	4	5	6	7	8	9	10	work ability at present

2. Work ability in relation to the demands of the job

How do you rate your current work ability with respect to the physical demands of your work?

very good	5
rather good	4
amoderate	3
rather poor	2
very poor	1

How do you rate your current work ability with respect to the mental demands of your work?

very good	5
rather good	4
amoderate	3
rather poor	2
very poor	1

Appendix 14: Patient-Health Questionnaire-9 items

PATIENT HEALTH QUESTIONNAIRE-9 (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems? (Use "✓" to indicate your answer)	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

FOR OFFICE CODING 0 + _____ + _____ + _____

=Total Score: _____

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult
☐	☐	☐	☐

Developed by Drs. Robert L. Spitzer, Janet B.W. Williams, Kurt Kroenke and colleagues, with an educational grant from Pfizer Inc. No permission required to reproduce, translate, display or distribute.

Appendix 15: Short Form-36™ questions version 2

SF-36v2

Date: _____ Sebastien Participant ID: _____

Your Health and Well-Being

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. ***Thank you for completing this survey!***

For each of the following questions, please mark an ☒ in the one box that best describes your answer.

1. **In general, would you say your health is:**

Excellent	Very good	Good	Fair	Poor
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

2. **<u>Compared to one year ago</u>, how would you rate your health in general <u>now</u>?**

Much better now than one year ago	Somewhat better now than one year ago	About the same as one year ago	Somewhat worse now than one year ago	Much worse now than one year ago
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

SF-36v2

The following questions are about activities you might do during a typical day. Does <u>your health now limit you</u> in these activities? If so, how much?

	Yes, limited a lot	Yes, limited a little	No, not limited at all
3. <u>Vigorous activities</u>, such as running, lifting heavy objects, participating in strenuous sports	☐ 1	☐ 2	☐ 3
4. <u>Moderate activities</u>, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	☐ 1	☐ 2	☐ 3
5. Lifting or carrying groceries	☐ 1	☐ 2	☐ 3
6. Climbing <u>several</u> flights of stairs	☐ 1	☐ 2	☐ 3
7. Climbing <u>one</u> flight of stairs	☐ 1	☐ 2	☐ 3
8. Bending, kneeling, or stooping	☐ 1	☐ 2	☐ 3
9. Walking <u>more than a kilometre</u>	☐ 1	☐ 2	☐ 3
10. Walking <u>several hundred metres</u>	☐ 1	☐ 2	☐ 3
11. Walking <u>one hundred metres</u>	☐ 1	☐ 2	☐ 3
12. Bathing or dressing yourself	☐ 1	☐ 2	☐ 3

SF-36v2

During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
13. Cut down on the amount of time you spent on work or other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
14. Accomplished less than you would like	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
15. Were limited in the kind of work or other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
16. Had difficulty performing the work or other activities (for example, it took extra effort)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

During the past 4 weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
17. Cut down on the amount of time you spent on work or other activities	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
18. Accomplished less than you would like	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
19. Did work or other activities less carefully than usual	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

20. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbours, or groups?

Not at all	Slightly	Moderately	Quite a bit	Extremely
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

21. How much bodily pain have you had during the past 4 weeks?

None	Very mild	Mild	Moderate	Severe	Very severe
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6

22. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

Not at all	A little bit	Moderately	Quite a bit	Extremely
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

SF-36v2

These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks…

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
23. Did you feel full of life?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
24. Have you been very nervous?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
25. Have you felt so down in the dumps that nothing could cheer you up?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
26. Have you felt calm and peaceful?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
27. Did you have a lot of energy?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
28. Have you felt downhearted and depressed?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
29. Did you feel worn out?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
30. Have you been happy?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
31. Did you feel tired?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

32. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

All of the time	Most of the time	Some of the time	A little of the time	None of the time
☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

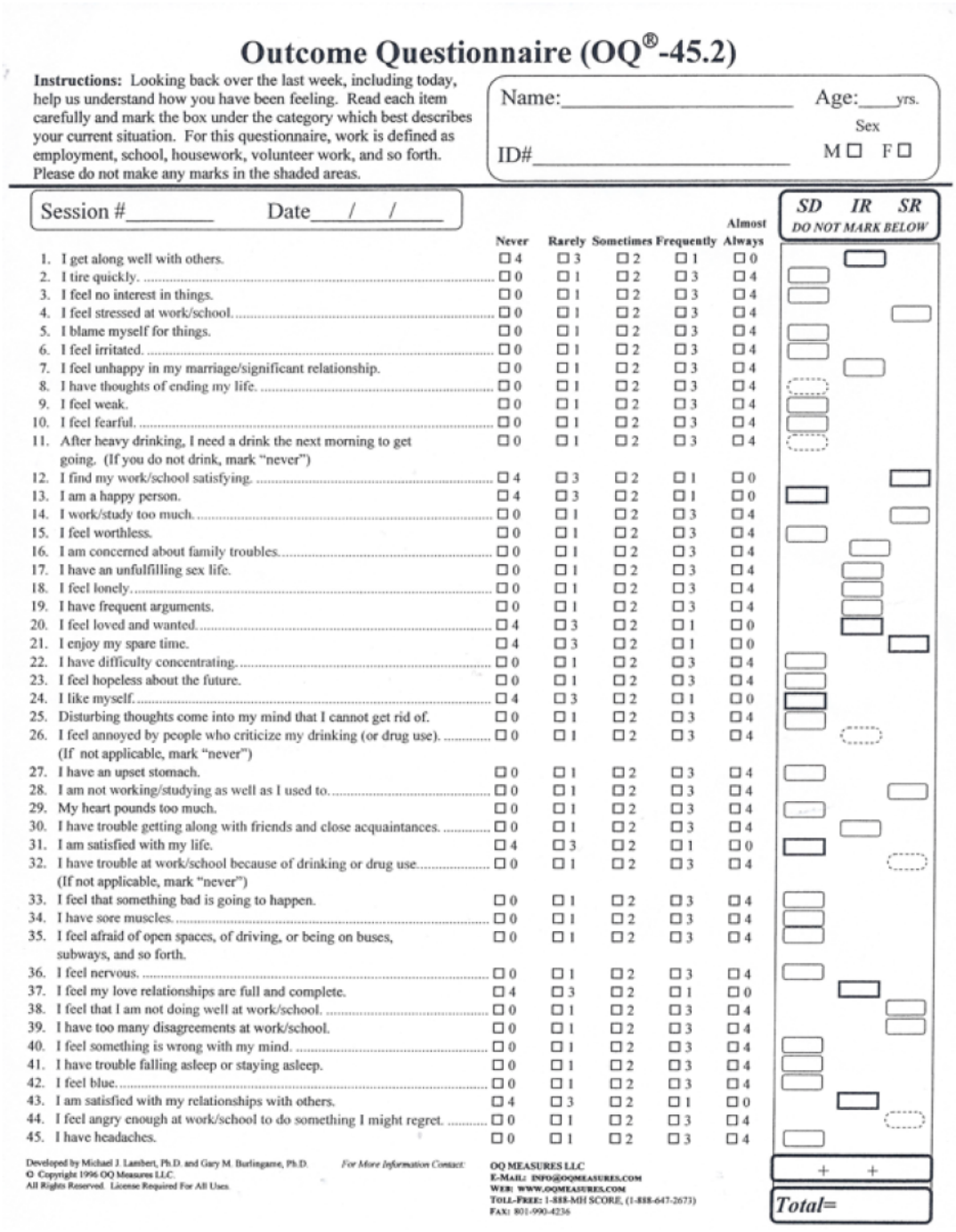
SF-36v2

11. How TRUE or FALSE is <u>each</u> of the following statements for you?

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
33. I seem to get sick a little easier than other people	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
34. I am as healthy as anybody I know	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
35. I expect my health to get worse	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
36. My health is excellent	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

Thank you for completing these questions!

Appendix 16: Outcome Questionnaire® 45.2



Outcome Questionnaire (OQ®-45.2)

Instructions: Looking back over the last week, including today, help us understand how you have been feeling. Read each item carefully and mark the box under the category which best describes your current situation. For this questionnaire, work is defined as employment, school, housework, volunteer work, and so forth. Please do not make any marks in the shaded areas.

Name:_____ Age:____yrs.

Sex M☐ F☐

ID#_____

Session #_____ Date___/___/_____

	Never	Rarely	Sometimes	Frequently	Almost Always
1. I get along well with others.	☐4	☐3	☐2	☐1	☐0
2. I tire quickly.	☐0	☐1	☐2	☐3	☐4
3. I feel no interest in things.	☐0	☐1	☐2	☐3	☐4
4. I feel stressed at work/school.	☐0	☐1	☐2	☐3	☐4
5. I blame myself for things.	☐0	☐1	☐2	☐3	☐4
6. I feel irritated.	☐0	☐1	☐2	☐3	☐4
7. I feel unhappy in my marriage/significant relationship.	☐0	☐1	☐2	☐3	☐4
8. I have thoughts of ending my life.	☐0	☐1	☐2	☐3	☐4
9. I feel weak.	☐0	☐1	☐2	☐3	☐4
10. I feel fearful.	☐0	☐1	☐2	☐3	☐4
11. After heavy drinking, I need a drink the next morning to get going. (If you do not drink, mark "never")	☐0	☐1	☐2	☐3	☐4
12. I find my work/school satisfying.	☐4	☐3	☐2	☐1	☐0
13. I am a happy person.	☐4	☐3	☐2	☐1	☐0
14. I work/study too much.	☐0	☐1	☐2	☐3	☐4
15. I feel worthless.	☐0	☐1	☐2	☐3	☐4
16. I am concerned about family troubles.	☐0	☐1	☐2	☐3	☐4
17. I have an unfulfilling sex life.	☐0	☐1	☐2	☐3	☐4
18. I feel lonely.	☐0	☐1	☐2	☐3	☐4
19. I have frequent arguments.	☐0	☐1	☐2	☐3	☐4
20. I feel loved and wanted.	☐4	☐3	☐2	☐1	☐0
21. I enjoy my spare time.	☐4	☐3	☐2	☐1	☐0
22. I have difficulty concentrating.	☐0	☐1	☐2	☐3	☐4
23. I feel hopeless about the future.	☐0	☐1	☐2	☐3	☐4
24. I like myself.	☐4	☐3	☐2	☐1	☐0
25. Disturbing thoughts come into my mind that I cannot get rid of.	☐0	☐1	☐2	☐3	☐4
26. I feel annoyed by people who criticize my drinking (or drug use). (If not applicable, mark "never")	☐0	☐1	☐2	☐3	☐4
27. I have an upset stomach.	☐0	☐1	☐2	☐3	☐4
28. I am not working/studying as well as I used to.	☐0	☐1	☐2	☐3	☐4
29. My heart pounds too much.	☐0	☐1	☐2	☐3	☐4
30. I have trouble getting along with friends and close acquaintances.	☐0	☐1	☐2	☐3	☐4
31. I am satisfied with my life.	☐4	☐3	☐2	☐1	☐0
32. I have trouble at work/school because of drinking or drug use. (If not applicable, mark "never")	☐0	☐1	☐2	☐3	☐4
33. I feel that something bad is going to happen.	☐0	☐1	☐2	☐3	☐4
34. I have sore muscles.	☐0	☐1	☐2	☐3	☐4
35. I feel afraid of open spaces, of driving, or being on buses, subways, and so forth.	☐0	☐1	☐2	☐3	☐4
36. I feel nervous.	☐0	☐1	☐2	☐3	☐4
37. I feel my love relationships are full and complete.	☐4	☐3	☐2	☐1	☐0
38. I feel that I am not doing well at work/school.	☐0	☐1	☐2	☐3	☐4
39. I have too many disagreements at work/school.	☐0	☐1	☐2	☐3	☐4
40. I feel something is wrong with my mind.	☐0	☐1	☐2	☐3	☐4
41. I have trouble falling asleep or staying asleep.	☐0	☐1	☐2	☐3	☐4
42. I feel blue.	☐0	☐1	☐2	☐3	☐4
43. I am satisfied with my relationships with others.	☐4	☐3	☐2	☐1	☐0
44. I feel angry enough at work/school to do something I might regret.	☐0	☐1	☐2	☐3	☐4
45. I have headaches.	☐0	☐1	☐2	☐3	☐4

SD	*IR*	*SR*
DO NOT MARK BELOW		

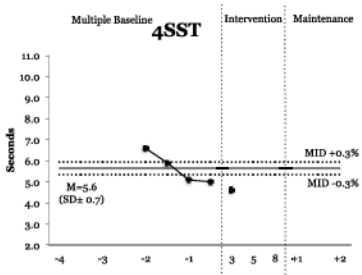
\+ +

Total=

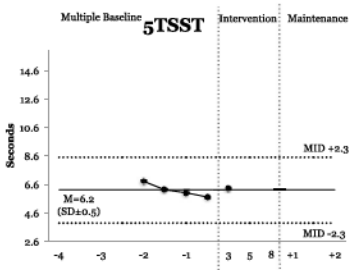
For More Information Contact:

OQ MEASURES LLC
E-MAIL: INFO@OQMEASURES.COM
WEB: WWW.OQMEASURES.COM
TOLL-FREE: 1-888-MH SCORE, (1-888-647-2673)
FAX: 801-990-4236

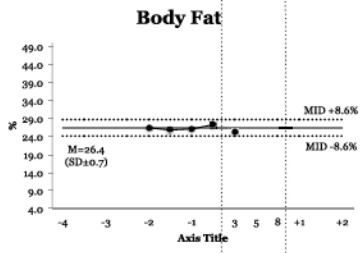
Appendix 17: Visual analysis for case 1



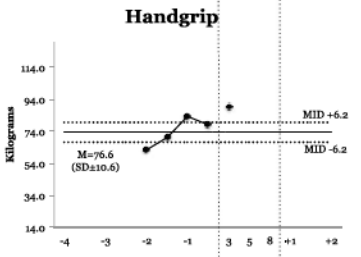
Level	Changed
Effect Size	1.4
Trend	Decreasing
Variability	Variable
Immediacy	Not applicable
Overlap	Absent
Anomalies	None
Notation	+



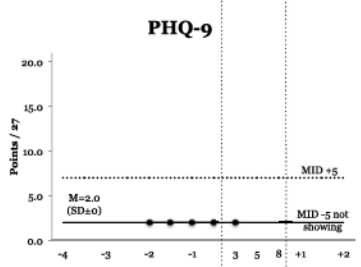
Level	Unchanged
Effect Size	-0.2
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	None
Notation	o



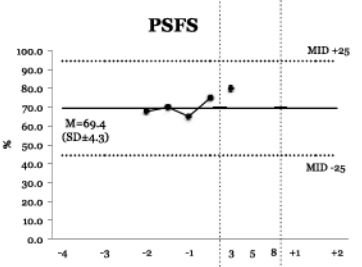
Level	Changed
Effect Size	1.8
Trend	Decreasing
Variability	Variable
Immediacy	Not applicable
Overlap	Some
Anomalies	Absent
Notation	o



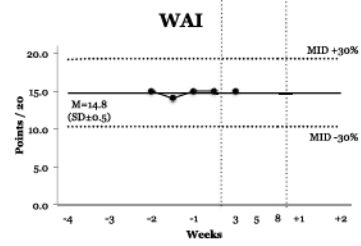
Level	Changed
Effect Size	-1.8
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	Absent
Anomalies	Week -1
Notation	+



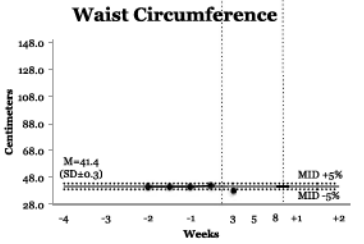
Level	Unchanged
Effect Size	Undefined
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o



Level	Changed
Effect Size	-2.5
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	Absent
Anomalies	Absent
Notation	o



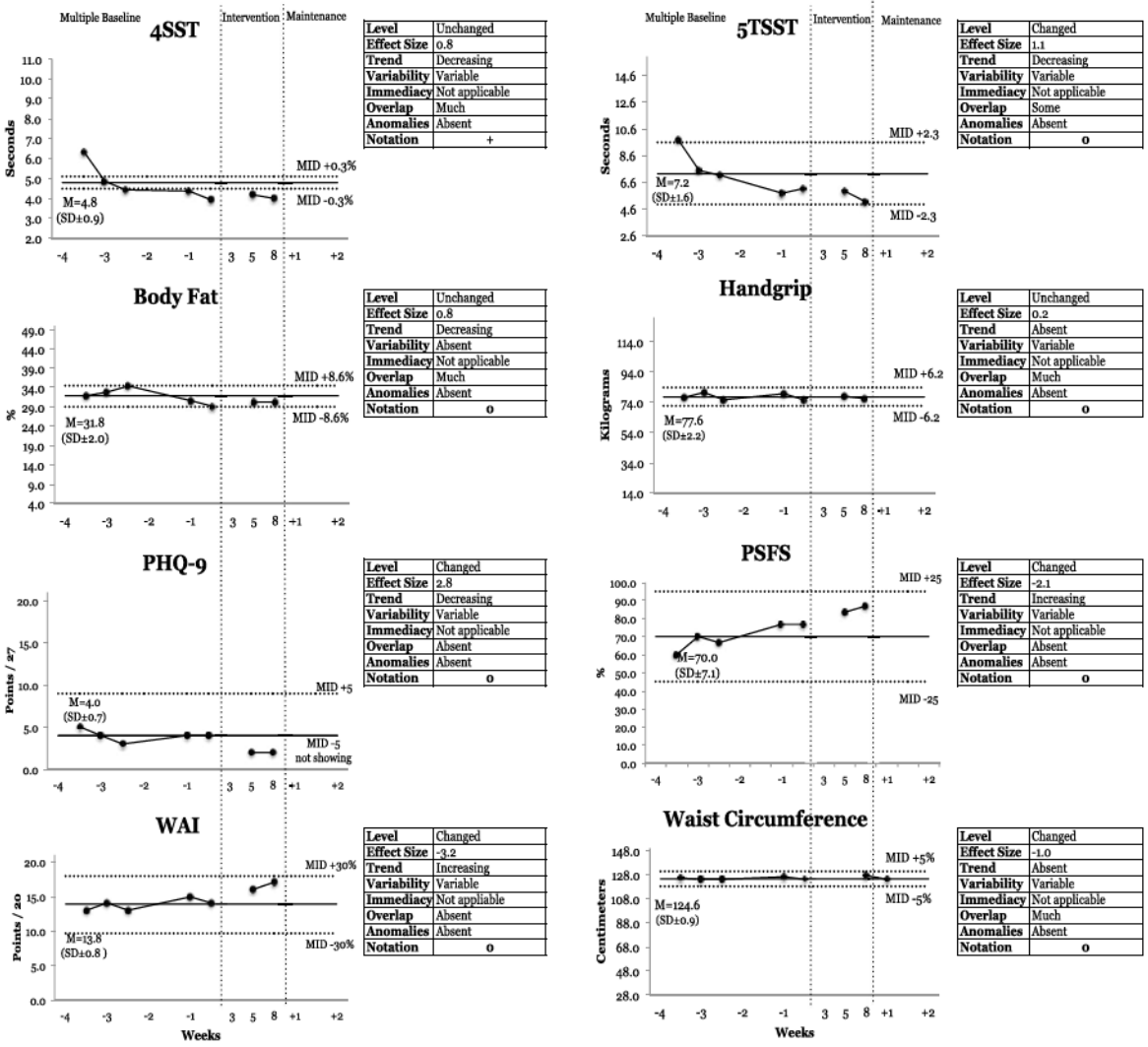
Level	Unchanged
Effect Size	-0.5
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



Level	Changed
Effect Size	11.3
Trend	Decreasing
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	+

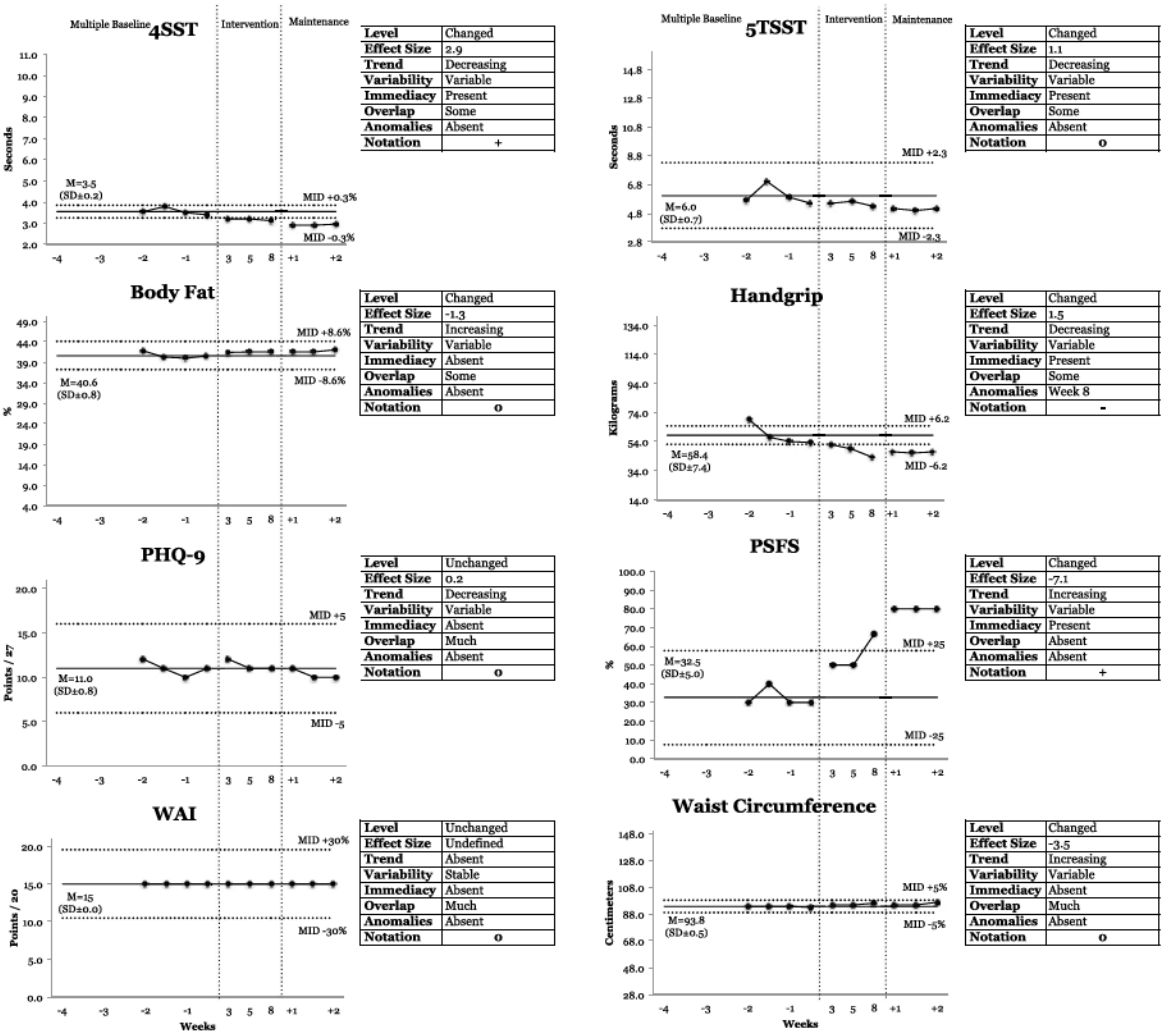
Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

Appendix 18: Visual analysis for case 2



Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

Appendix 19: Visual analysis for case 3



Level	Changed
Effect Size	2.9
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	+

Level	Changed
Effect Size	1.1
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	o

Level	Changed
Effect Size	-1.3
Trend	Increasing
Variability	Variable
Immediacy	Absent
Overlap	Some
Anomalies	Absent
Notation	o

Level	Changed
Effect Size	1.5
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Week 8
Notation	-

Level	Unchanged
Effect Size	0.2
Trend	Decreasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o

Level	Changed
Effect Size	-7.1
Trend	Increasing
Variability	Variable
Immediacy	Present
Overlap	Absent
Anomalies	Absent
Notation	+

Level	Unchanged
Effect Size	Undefined
Trend	Absent
Variability	Stable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o

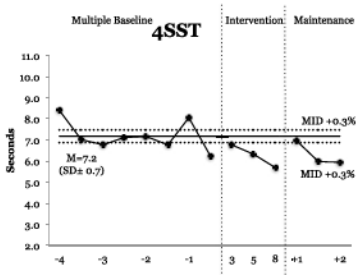
Level	Changed
Effect Size	-3.5
Trend	Increasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

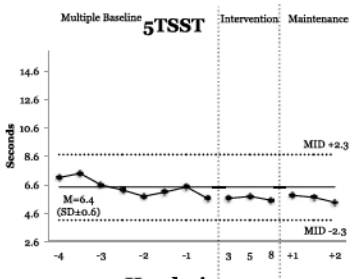
Exemplar of Analysis

Case 3 improved in 4SST since the values in the maintenance phase were outside the MID lower limit. This improvement was large (effect size 2.9) despite some variability in the data. This is even stronger cause-inference since immediacy was present without anomalies (but some overlap). A notation + was therefore given. The PSFS improved since the values in the maintenance phase finished outside the upper MID, with a large effect size (-7.1). This increasing trend had some immediacy and no overlap nor anomalies. A notation + was therefore given. There was a decrease in handgrip since the values in the maintenance phase were lower than the MID lower limit. This decreasing trend was modest (effect size 1.5) and had some variability, immediacy and overlap. A notation – was therefore given. 5TSST, body fat, handgrip, PHQ-9, WAI and waist circumference had final values in the maintenance phase remaining within MID limits. Therefore, the notation given was o.

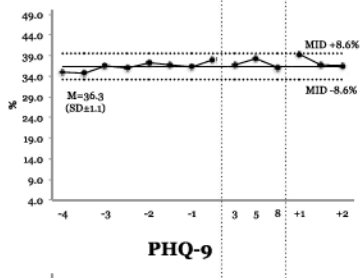
Appendix 20: Visual analysis for case 4



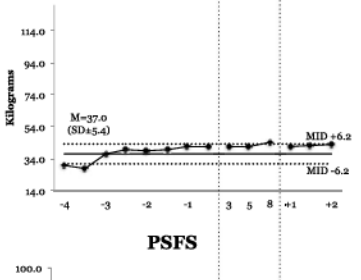
Level	Changed
Effect Size	1.3
Trend	Decreasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week -1, +1
Notation	+



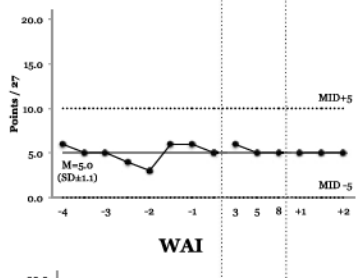
Level	Changed
Effect Size	1.3
Trend	Decreasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



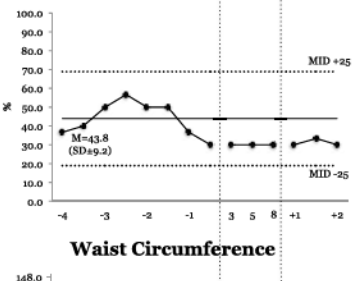
Level	Changed
Effect Size	-0.9
Trend	Decreasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Weeks 3, 8, +1
Notation	o



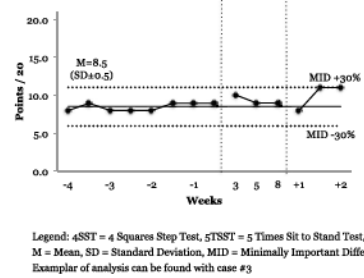
Level	Changed
Effect Size	-1.0
Trend	Increasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week 8
Notation	o



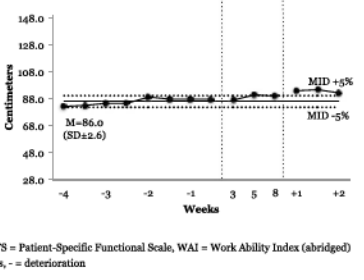
Level	Unchanged
Effect Size	-0.2
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week -2, 3
Notation	o



Level	Changed
Effect Size	1.4
Trend	Decreasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week -1
Notation	o



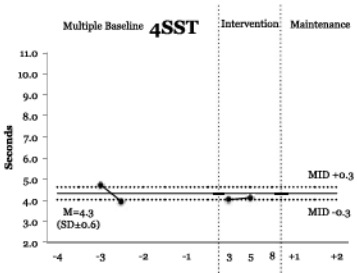
Level	Changed
Effect Size	-2.2
Trend	Increasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week +1
Notation	o



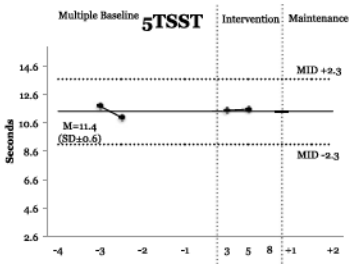
Level	Changed
Effect Size	-2.1
Trend	Increasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	None
Notation	+

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

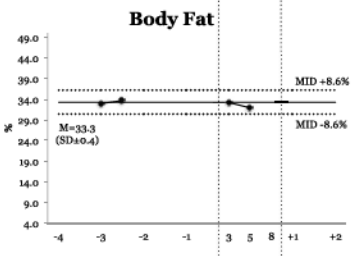
Appendix 21: Visual analysis for case 5



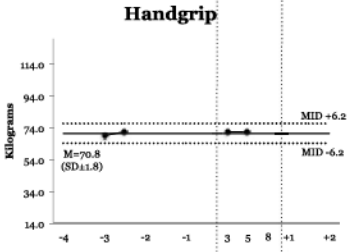
Level	Unchanged
Effect Size	0.4
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	0



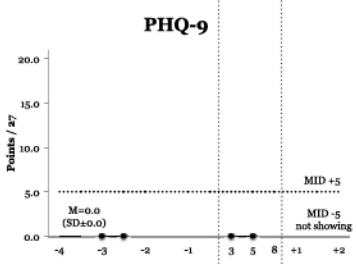
Level	Unchanged
Effect Size	-0.2
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	0



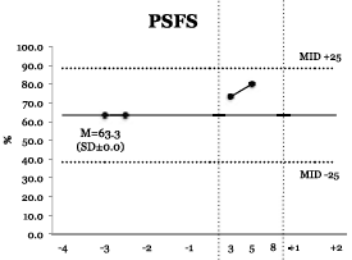
Level	Changed
Effect Size	1.8
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	0



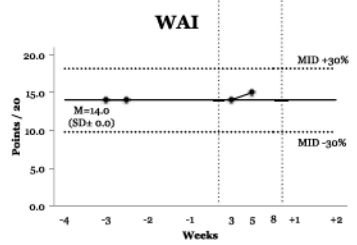
Level	Unchanged
Effect Size	-0.5
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	0



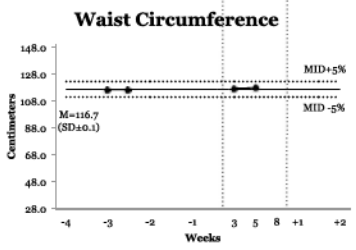
Level	Unchanged
Effect Size	Undefined
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	0



Level	Not applicable
Effect Size	Undefined
Trend	Increasing
Variability	Stable
Immediacy	Not applicable
Overlap	Absent
Anomalies	None
Notation	0



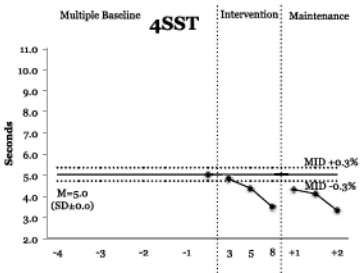
Level	Not applicable
Effect Size	Undefined
Trend	Increasing
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	0



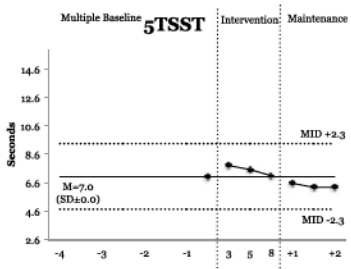
Level	Changed
Effect Size	-12.7
Trend	Increasing
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	0

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, 0 = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

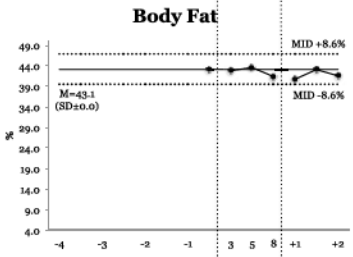
Appendix 22: Visual analysis for case 6



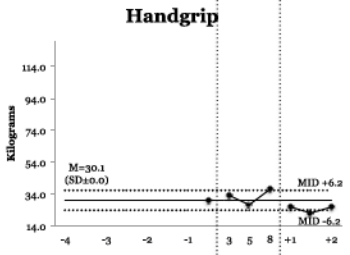
Level	Not Applicable
Effect Size	Not Applicable
Trend	Decreasing
Variability	Not Applicable
Immediacy	Absent
Overlap	Much
Anomalies	Week +1
Notation	+



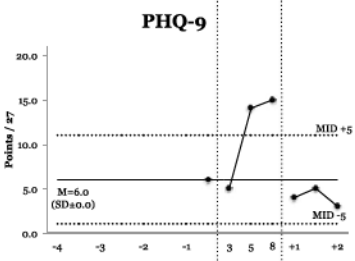
Level	Not Applicable
Effect Size	Not Applicable
Trend	Decreasing
Variability	Not Applicable
Immediacy	Present
Overlap	Some
Anomalies	Weeks 3, 5
Notation	o



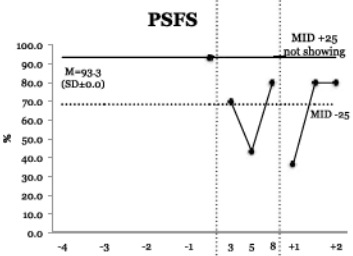
Level	Not Applicable
Effect Size	Not Applicable
Trend	Increasing
Variability	Not Applicable
Immediacy	Absent
Overlap	Much
Anomalies	Weeks 8, +1
Notation	o



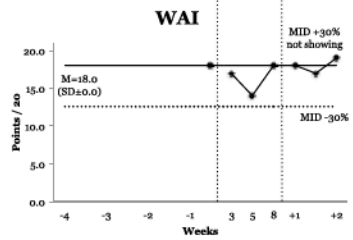
Level	Not Applicable
Effect Size	Not Applicable
Trend	Decreasing
Variability	Not Applicable
Immediacy	Absent
Overlap	Some
Anomalies	Weeks 8, +2
Notation	o



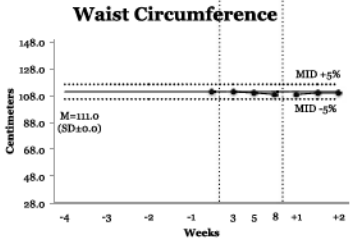
Level	Not Applicable
Effect Size	Not Applicable
Trend	Decreasing
Variability	Not Applicable
Immediacy	Absent
Overlap	Some
Anomalies	Weeks 5, 8
Notation	o



Level	Not Applicable
Effect Size	Not Applicable
Trend	Absent
Variability	Not Applicable
Immediacy	Absent
Overlap	Much
Anomalies	Weeks 5, +1
Notation	o



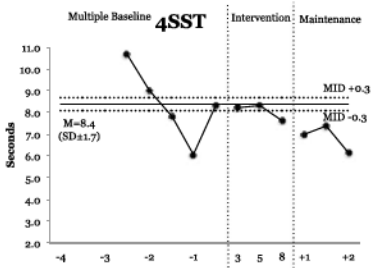
Level	Not Applicable
Effect Size	Not Applicable
Trend	Increasing
Variability	Not Applicable
Immediacy	Absent
Overlap	Some
Anomalies	Weeks 3, 5
Notation	o



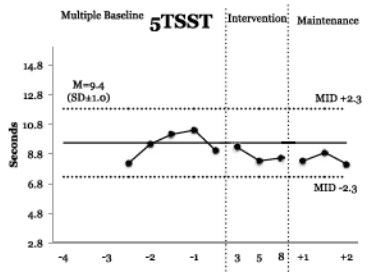
Level	Not Applicable
Effect Size	Not Applicable
Trend	Increasing
Variability	Not Applicable
Immediacy	Absent
Overlap	Much
Anomalies	Weeks 5, 8, +1
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

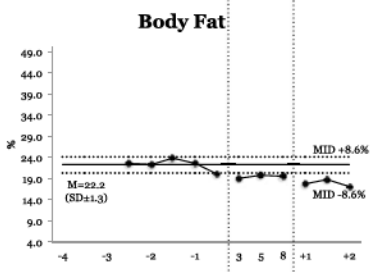
Appendix 23: Visual analysis for case 7



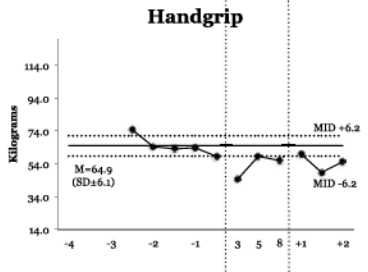
Level	Unchanged
Effect Size	0.6
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Much
Anomalies	Between -3 and -2
Notation	+



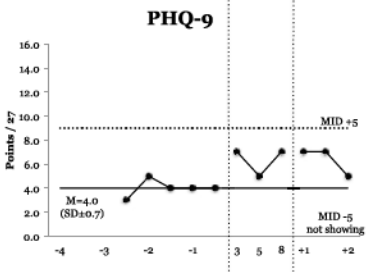
Level	Changed
Effect Size	0.9
Trend	Decreasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



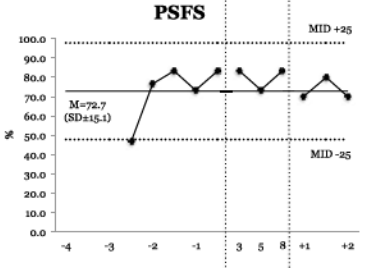
Level	Changed
Effect Size	2.7
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Absent
Anomalies	Absent
Notation	+



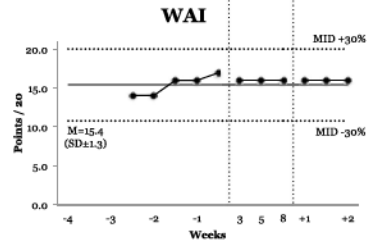
Level	Changed
Effect Size	1.8
Trend	Decreasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Weeks 3, +1
Notation	-



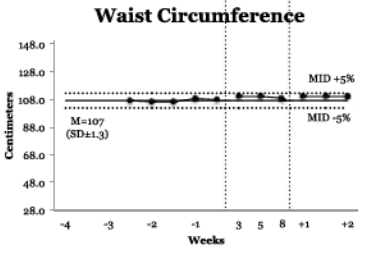
Level	Changed
Effect Size	-3.3
Trend	Increasing
Variability	Stable
Immediacy	Present
Overlap	Much
Anomalies	Weeks 5, +2
Notation	o



Level	Unchanged
Effect Size	-0.3
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Between -3 and -2
Notation	o



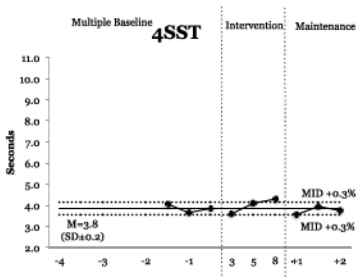
Level	Unchanged
Effect Size	-0.4
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



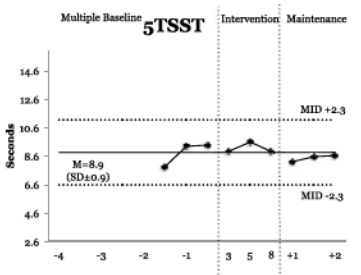
Level	Changed
Effect Size	-2.0
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

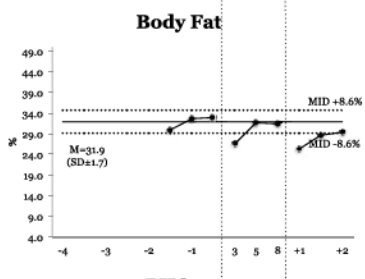
Appendix 24: Visual analysis for case 8



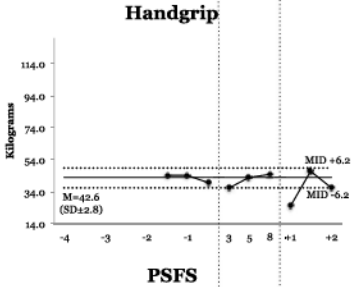
Level	Unchanged
Effect Size	-0.1
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Some
Anomalies	Absent
Notation	o



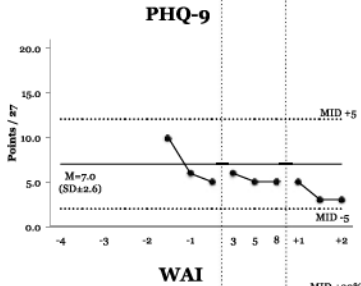
Level	Unchanged
Effect Size	0.1
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



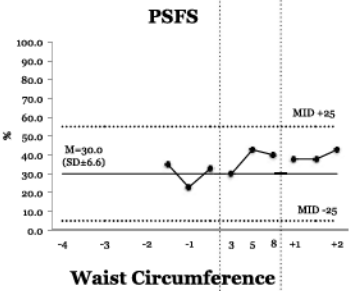
Level	Changed
Effect Size	1.8
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Between -3, -2
Notation	+



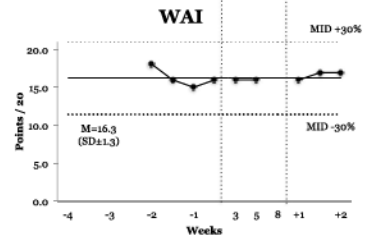
Level	Changed
Effect Size	1.4
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Week +1
Notation	o



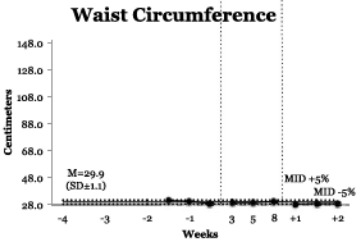
Level	Changed
Effect Size	0.9
Trend	Decreasing
Variability	Variable
Immediacy	Not applicable
Overlap	Some
Anomalies	Absent
Notation	o



Level	Changed
Effect Size	-1.3
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Between -4, -3
Notation	o



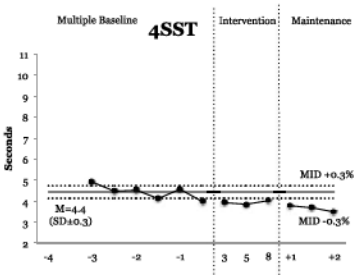
Level	Unchanged
Effect Size	-0.1
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o



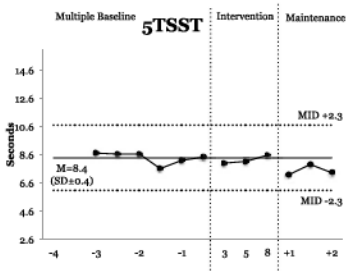
Level	Unchanged
Effect Size	0.5
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Some
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

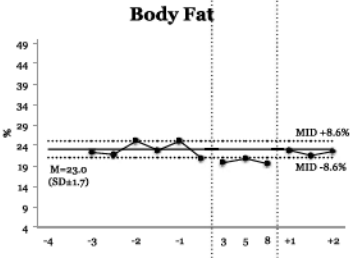
Appendix 25: Visual analysis for case 9



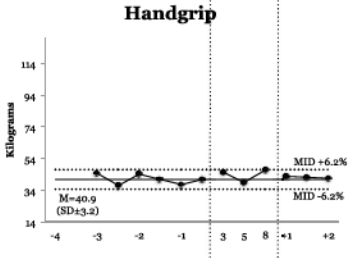
Level	Changed
Effect Size	1.9
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	+



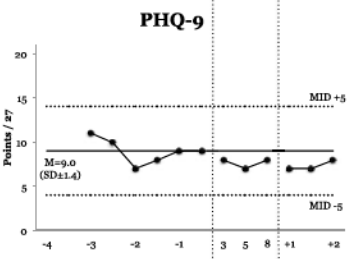
Level	Changed
Effect Size	1.3
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	o



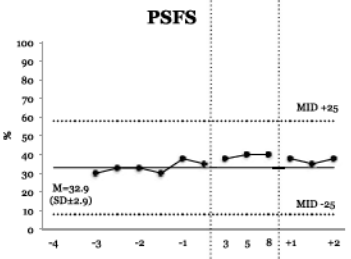
Level	Unchanged
Effect Size	1.1
Trend	Absent
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	o



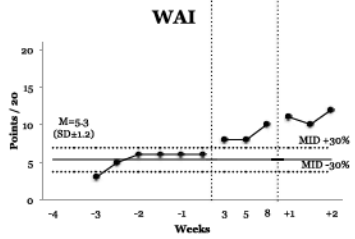
Level	Unchanged
Effect Size	-0.7
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Weeks 5, +1, +2
Notation	o



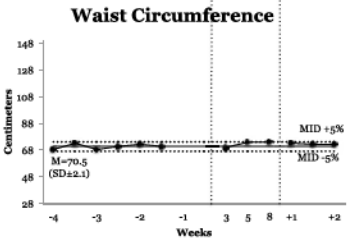
Level	Changed
Effect Size	1.1
Trend	Absent
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Week -2
Notation	o



Level	Changed
Effect Size	-1.7
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



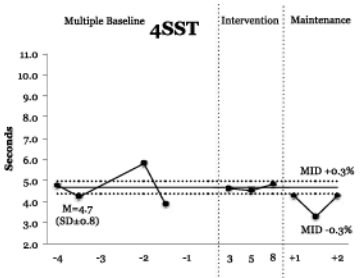
Level	Changed
Effect Size	-3.7
Trend	Increasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	+



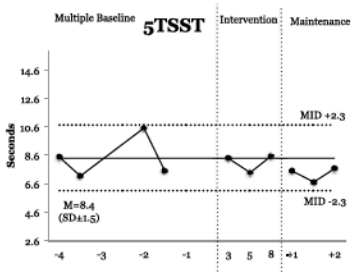
Level	Changed
Effect Size	-1.0
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Some
Anomalies	Week 5, 8
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

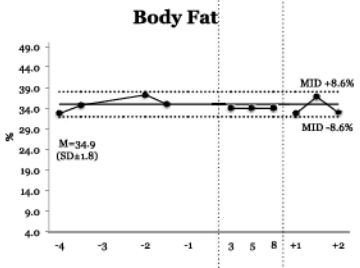
Appendix 26: Visual analysis for case 10



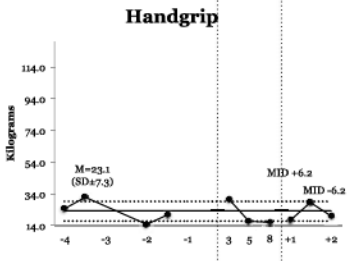
Level	Unchanged
Effect Size	0.4
Trend	Absent
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Week -2
Notation	+



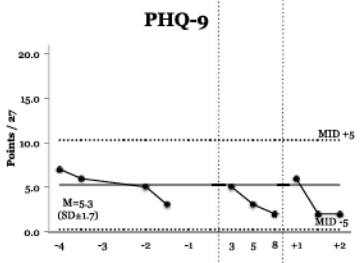
Level	Unchanged
Effect Size	0.5
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week -2
Notation	o



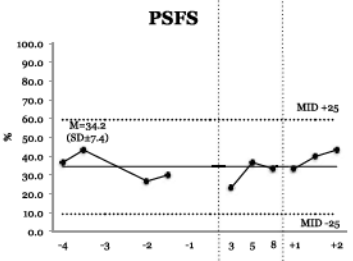
Level	Unchanged
Effect Size	0.4
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week -2
Notation	o



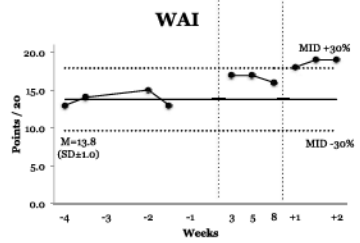
Level	Unchanged
Effect Size	0.2
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



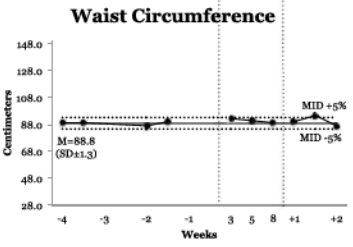
Level	Changed
Effect Size	1.1
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



Level	Unchanged
Effect Size	-0.1
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



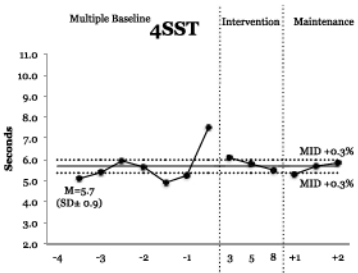
Level	Changed
Effect Size	-4.1
Trend	Increasing
Variability	Stable
Immediacy	Present
Overlap	Absent
Anomalies	Absent
Notation	+



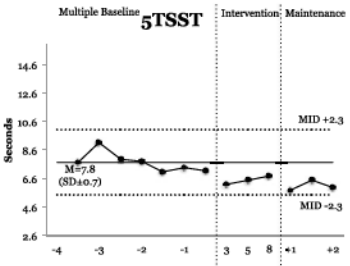
Level	Changed
Effect Size	-1.5
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Between +1, +2
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

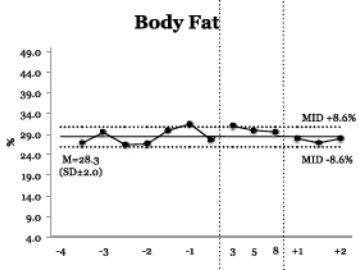
Appendix 27: Visual analysis for case 11



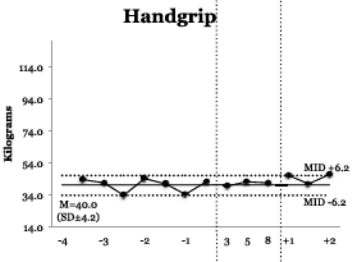
Level	Unchanged
Effect Size	0.0
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Between -1 and 3
Notation	o



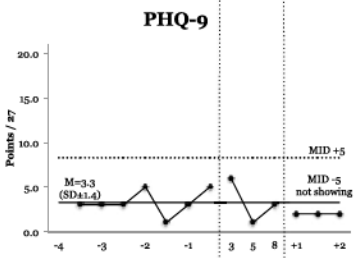
Level	Changed
Effect Size	2.1
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Some
Anomalies	Absent
Notation	o



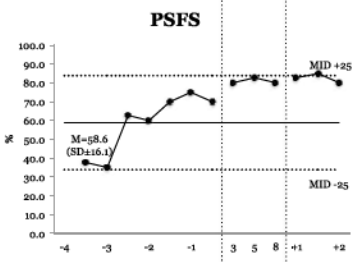
Level	Unchanged
Effect Size	-0.3
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



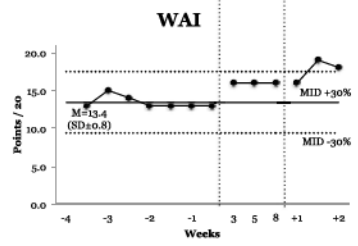
Level	Unchanged
Effect Size	-0.7
Trend	Increasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	+



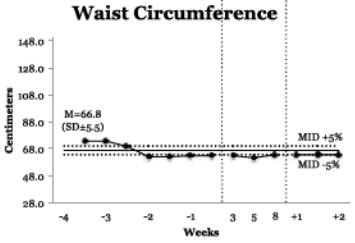
Level	Unchanged
Effect Size	0.4
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Between -2 and 5
Notation	o



Level	Changed
Effect Size	-1.4
Trend	Increasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



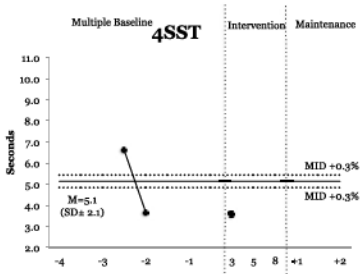
Level	Changed
Effect Size	-4.3
Trend	Increasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	+



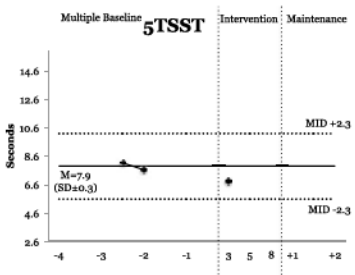
Level	Unchanged
Effect Size	0.7
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

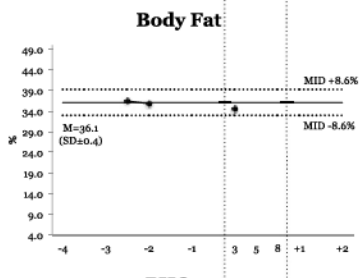
Appendix 28: Visual analysis for case 12



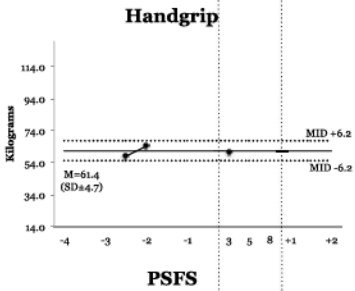
Level	Unchanged
Effect Size	0.7
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Absent
Anomalies	Between -3 and -2
Notation	+



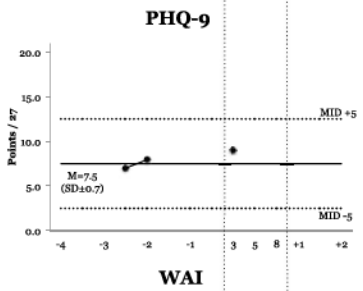
Level	Changed
Effect Size	3.1
Trend	Decreasing
Variability	Stable
Immediacy	Not applicable
Overlap	Absent
Anomalies	Absent
Notation	o



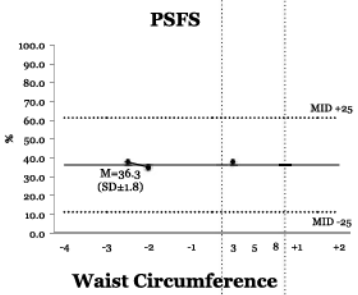
Level	Changed
Effect Size	4.0
Trend	Decreasing
Variability	Stable
Immediacy	Not applicable
Overlap	Absent
Anomalies	Absent
Notation	o



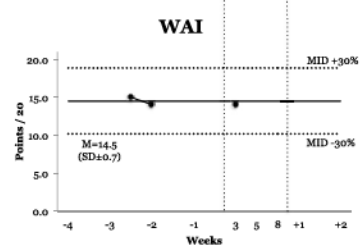
Level	Unchanged
Effect Size	0.2
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o



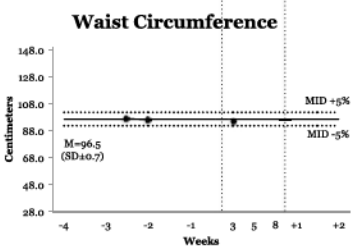
Level	Changed
Effect Size	-2.1
Trend	Increasing
Variability	Stable
Immediacy	Not applicable
Overlap	Absent
Anomalies	Absent
Notation	o



Level	Unchanged
Effect Size	-0.7
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o



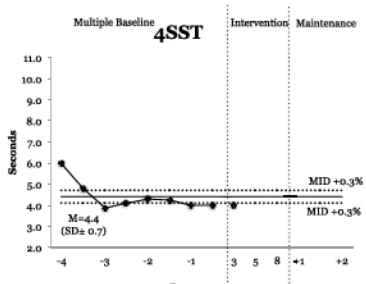
Level	Unchanged
Effect Size	0.7
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o



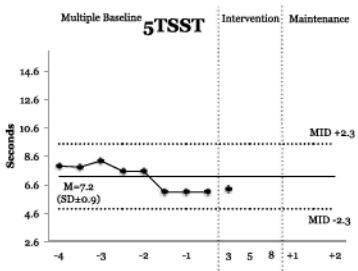
Level	Changed
Effect Size	2.1
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

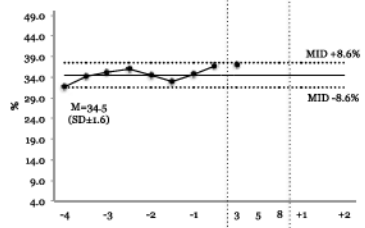
Appendix 29: Visual analysis for case 13



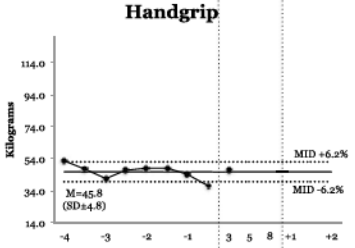
Level	Unchanged
Effect Size	0.6
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Week -3
Notation	+



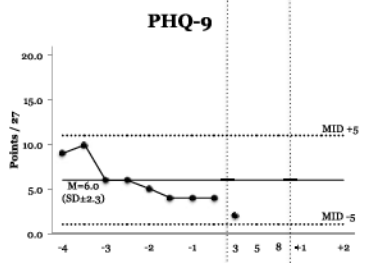
Level	Changed
Effect Size	1.0
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o



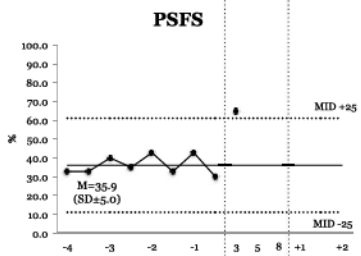
Level	Changed
Effect Size	-1.5
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o



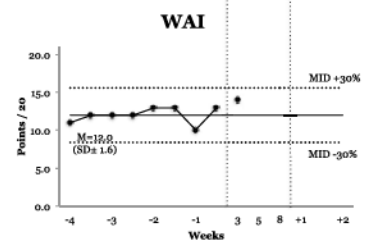
Level	Unchanged
Effect Size	-0.2
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Between -1, 3
Notation	o



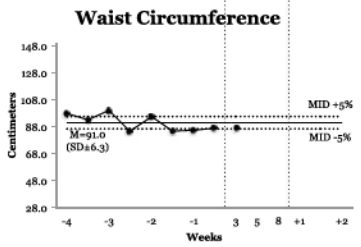
Level	Changed
Effect Size	1.7
Trend	Decreasing
Variability	Variable
Immediacy	Not applicable
Overlap	Absent
Anomalies	Absent
Notation	o



Level	Changed
Effect Size	-5.8
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	Absent
Anomalies	Absent
Notation	+



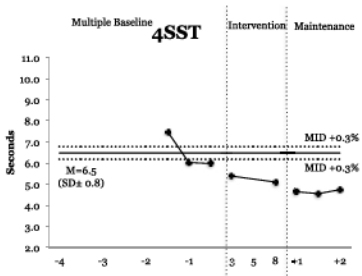
Level	Unchanged
Effect Size	-0.4
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	Absent
Anomalies	Week -1
Notation	o



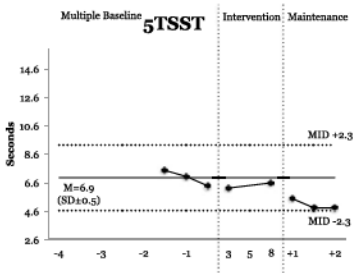
Level	Unchanged
Effect Size	0.7
Trend	Decreasing
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Weeks -3, -2
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

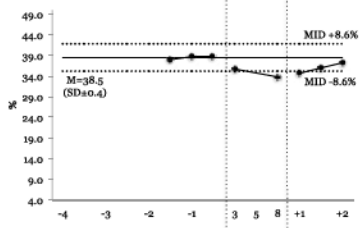
Appendix 30: Visual analysis for case 14



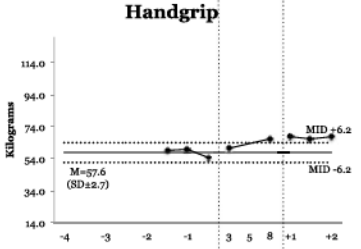
Level	Changed
Effect Size	1.9
Trend	Decreasing
Variability	Variable
Immediacy	Not applicable
Overlap	Absent
Anomalies	Absent
Notation	+



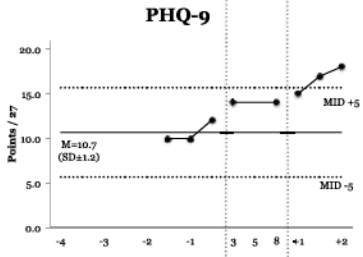
Level	Changed
Effect Size	2.6
Trend	Decreasing
Variability	Variable
Immediacy	Not applicable
Overlap	Some
Anomalies	Absent
Notation	o



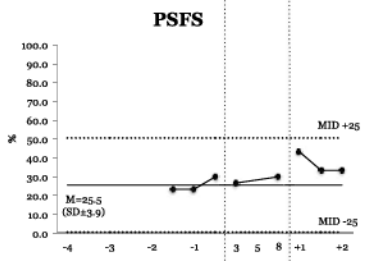
Level	Changed
Effect Size	6.8
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o



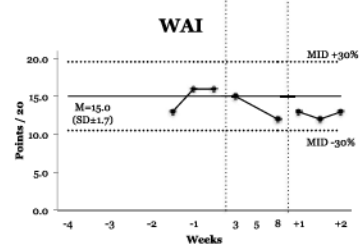
Level	Changed
Effect Size	-2.9
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	Some
Anomalies	Absent
Notation	+



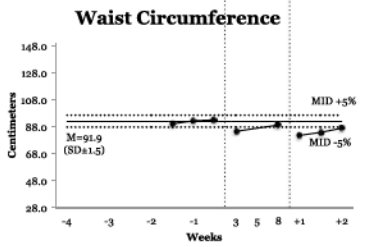
Level	Changed
Effect Size	-4.3
Trend	Increasing
Variability	Stable
Immediacy	Not applicable
Overlap	None
Anomalies	Absent
Notation	+



Level	Changed
Effect Size	-2.0
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Some
Anomalies	Week +1
Notation	o



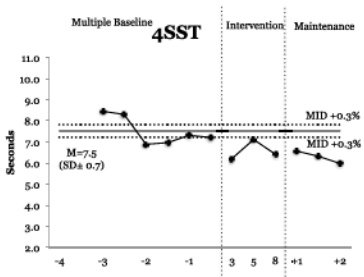
Level	Changed
Effect Size	1.2
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o



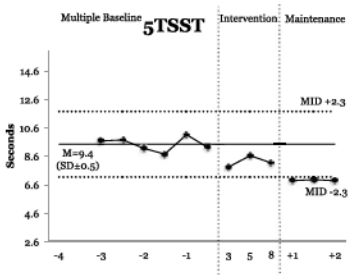
Level	Changed
Effect Size	4.5
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	+

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

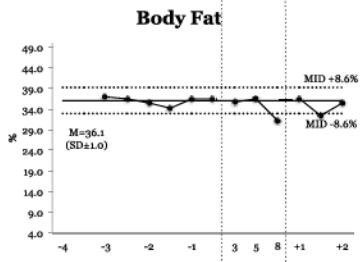
Appendix 31: Visual analysis for case 15



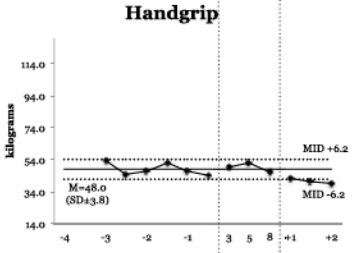
Level	Changed
Effect Size	1.6
Trend	Decreasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week 3
Notation	+



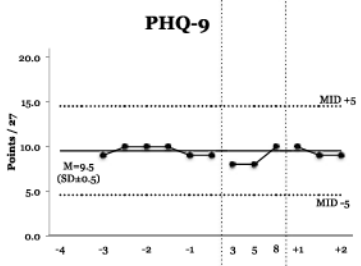
Level	Changed
Effect Size	3.8
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	+



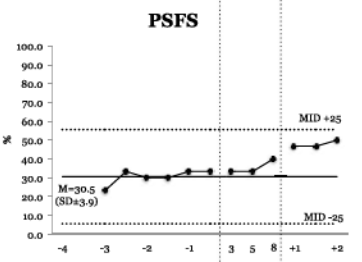
Level	Changed
Effect Size	1.4
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week 8
Notation	o



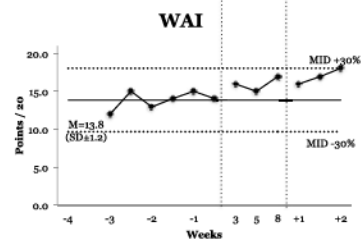
Level	Unchanged
Effect Size	0.8
Trend	Variable
Variability	Stable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	-



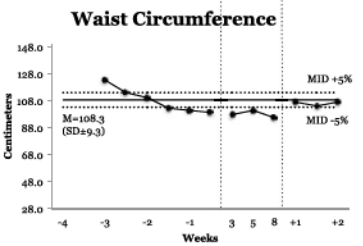
Level	Unchanged
Effect Size	0.9
Trend	Absent
Variability	Stable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



Level	Changed
Effect Size	-2.9
Trend	Increasing
Variability	Variable
Immediacy	Present
Overlap	None
Anomalies	Absent
Notation	o



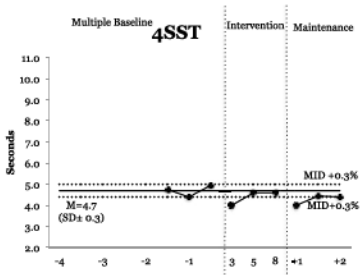
Level	Changed
Effect Size	-2.3
Trend	Increasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	+



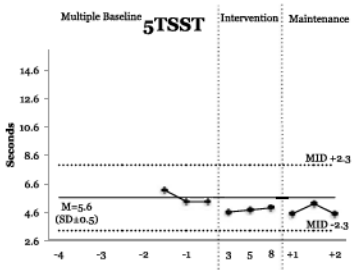
Level	Unchanged
Effect Size	0.7
Trend	Absent
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

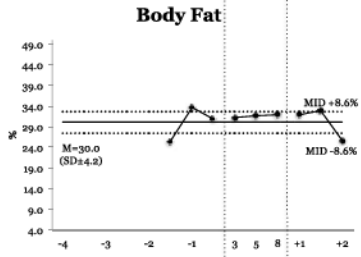
Appendix 32: Visual analysis for case 16



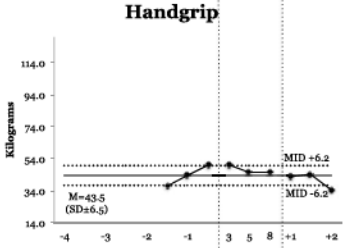
Level	Changed
Effect Size	1.2
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



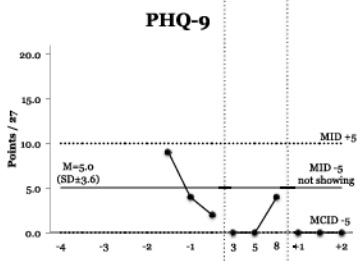
Level	Changed
Effect Size	1.9
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	o



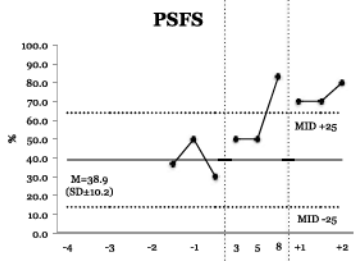
Level	Unchanged
Effect Size	-0.2
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week +2
Notation	+



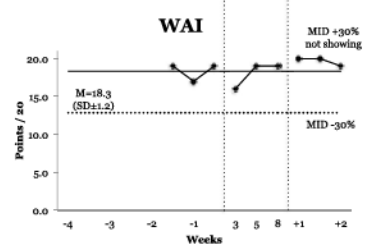
Level	Unchanged
Effect Size	0.0
Trend	Absent
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	-



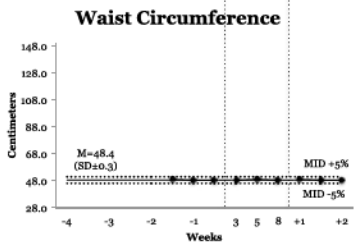
Level	Changed
Effect Size	1.2
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week 8
Notation	+



Level	Changed
Effect Size	-2.8
Trend	Increasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week 8
Notation	+



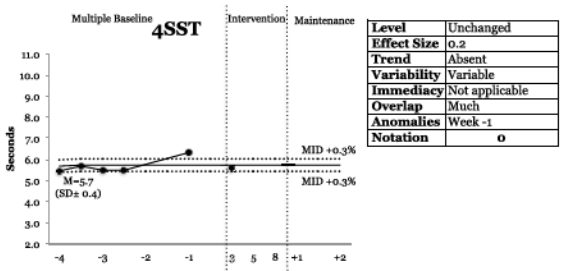
Level	Changed
Effect Size	-0.4
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week 3
Notation	+



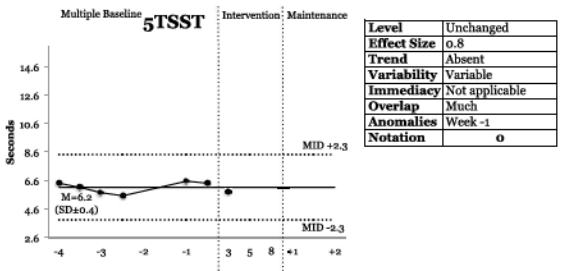
Level	Unchanged
Effect Size	0.3
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

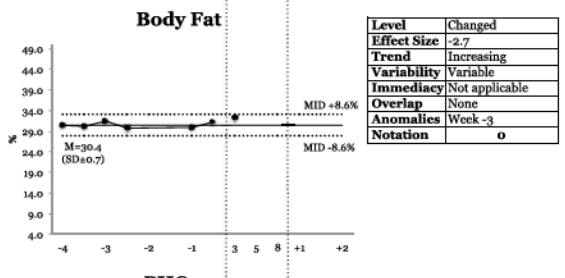
Appendix 33: Visual analysis for case 17



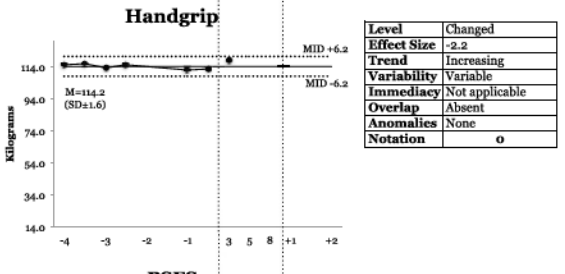
Level	Unchanged
Effect Size	0.2
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Week -1
Notation	o



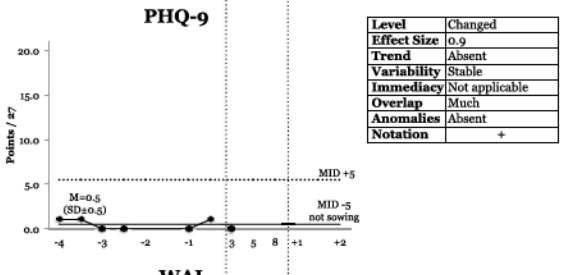
Level	Unchanged
Effect Size	0.8
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Week -1
Notation	o



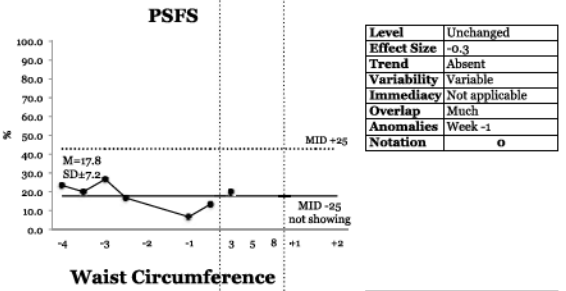
Level	Changed
Effect Size	-2.7
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	None
Anomalies	Week -3
Notation	o



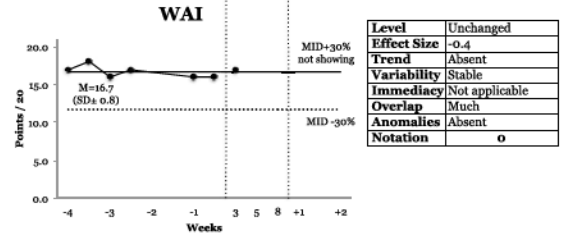
Level	Changed
Effect Size	-2.2
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	Absent
Anomalies	None
Notation	o



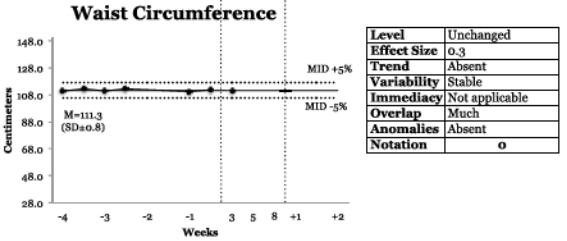
Level	Changed
Effect Size	0.9
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	+



Level	Unchanged
Effect Size	-0.3
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Week -1
Notation	o



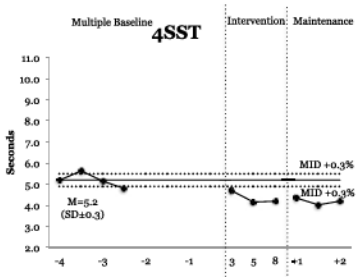
Level	Unchanged
Effect Size	-0.4
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o



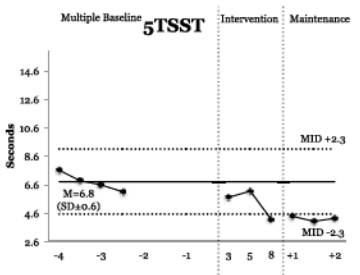
Level	Unchanged
Effect Size	0.3
Trend	Absent
Variability	Stable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

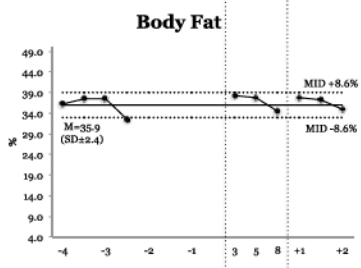
Appendix 34: Visual analysis for case 18



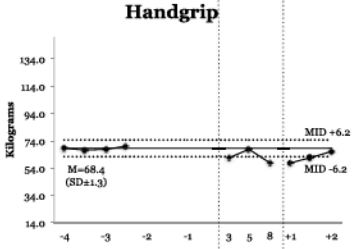
Level	Changed
Effect Size	2.8
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	+



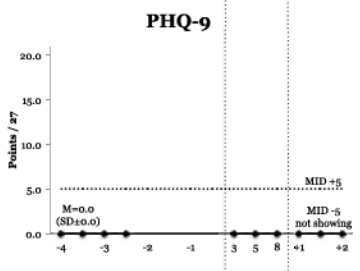
Level	Changed
Effect Size	3.2
Trend	Decreasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	+



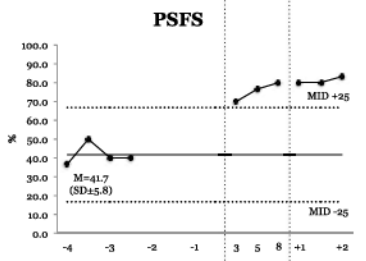
Level	Unchanged
Effect Size	-0.3
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Between -3 and -2
Notation	o



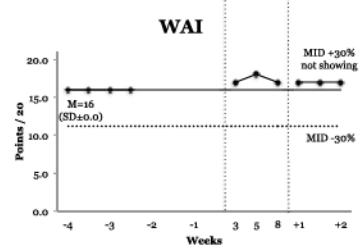
Level	Changed
Effect Size	4.7
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Weeks 8,+1
Notation	o



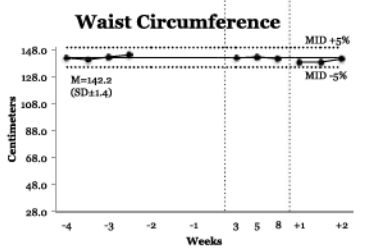
Level	Unchanged
Effect Size	Undefined
Trend	Absent
Variability	Stable
Immediacy	Absent
Overlap	Much
Anomalies	None
Notation	o



Level	Changed
Effect Size	-6.4
Trend	Increasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	+



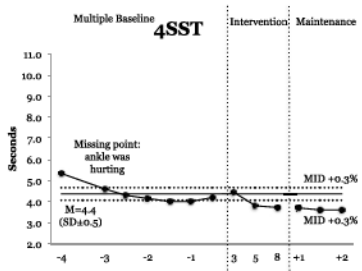
Level	Not applicable
Effect Size	Undefined
Trend	Increasing
Variability	Stable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	o



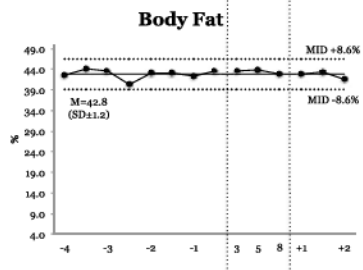
Level	Changed
Effect Size	1.0
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

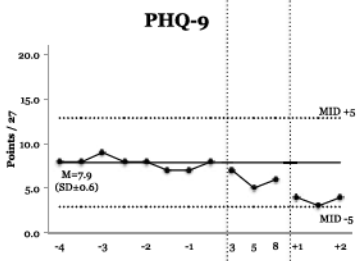
Appendix 35: Visual analysis for case 19



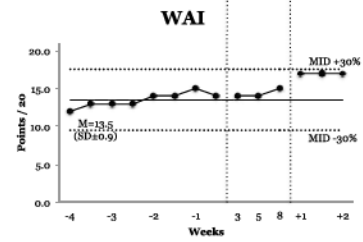
Level	Changed
Effect Size	1.2
Trend	Decreasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	+



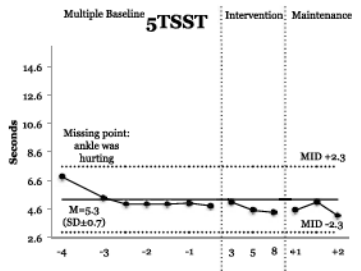
Level	Unchanged
Effect Size	-0.2
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



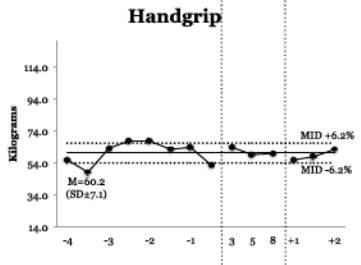
Level	Changed
Effect Size	4.7
Trend	Decreasing
Variability	Stable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	o



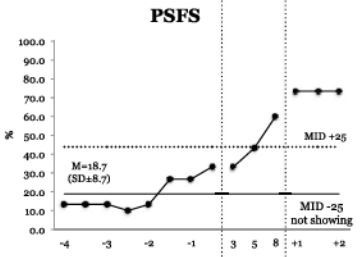
Level	Changed
Effect Size	-2.3
Trend	Increasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	o



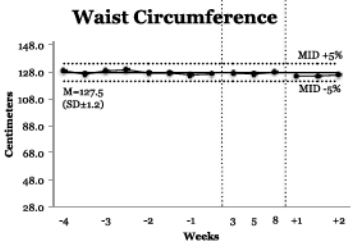
Level	Changed
Effect Size	0.9
Trend	Decreasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



Level	Unchanged
Effect Size	0.1
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Between -4, -3
Notation	o



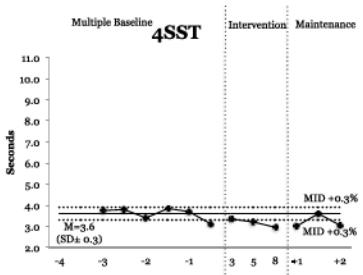
Level	Changed
Effect Size	-4.7
Trend	Increasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	+



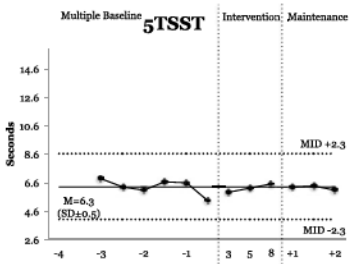
Level	Changed
Effect Size	1.0
Trend	Absent
Variability	Variable
Immediacy	None
Overlap	Much
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

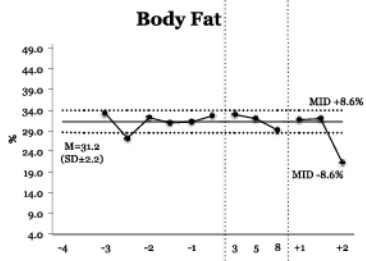
Appendix 36: Visual analysis for case 20



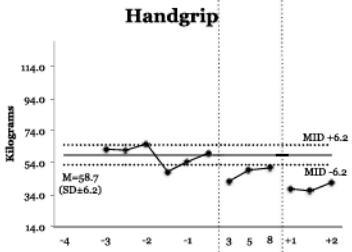
Level	Changed
Effect Size	1.4
Trend	Decreasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Between +1, +2
Notation	+



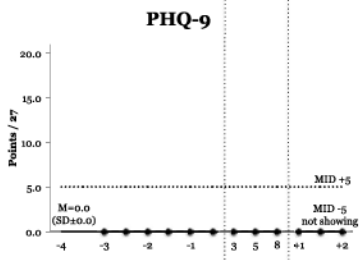
Level	Unchanged
Effect Size	0.2
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



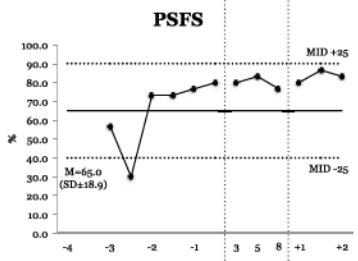
Level	Unchanged
Effect Size	0.6
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week +2
Notation	o



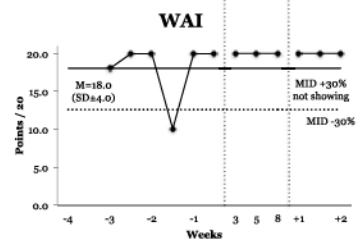
Level	Changed
Effect Size	2.5
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Between -2, 3
Notation	-



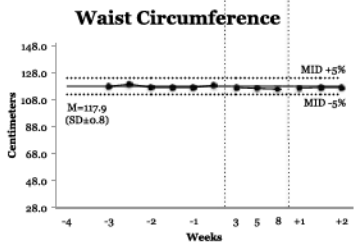
Level	Unchanged
Effect Size	Undefined
Trend	Absent
Variability	Stable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



Level	Changed
Effect Size	-0.9
Trend	Increasing
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Between -3 and -2
Notation	o



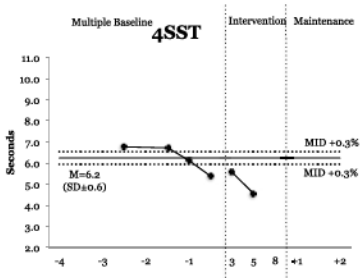
Level	Unchanged
Effect Size	-0.5
Trend	Stable
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Between -2,-1
Notation	+



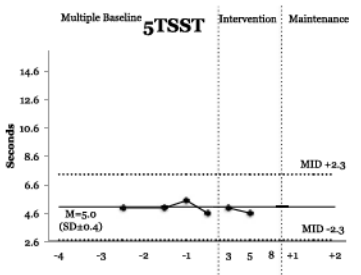
Level	Changed
Effect Size	1.5
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

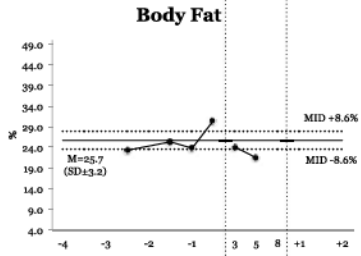
Appendix 37: Visual analysis for case 21



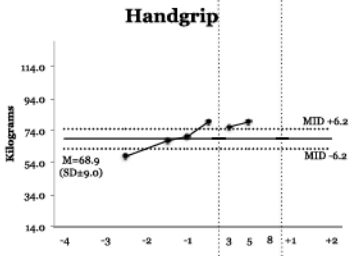
Level	Changed
Effect Size	1.8
Trend	Decreasing
Variability	Variable
Immediacy	Not applicable
Overlap	Some
Anomalies	Absent
Notation	+



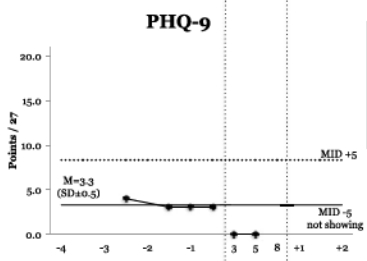
Level	Unchanged
Effect Size	0.6
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	o



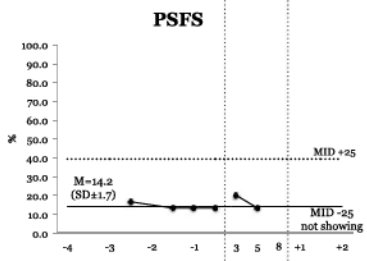
Level	Changed
Effect Size	0.9
Trend	Decreasing
Variability	Variable
Immediacy	Not applicable
Overlap	Some
Anomalies	Week -1
Notation	+



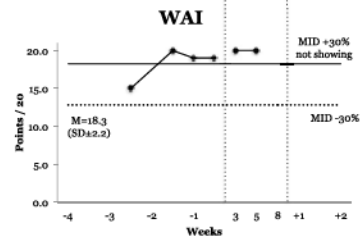
Level	Changed
Effect Size	-1.0
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Absent
Notation	+



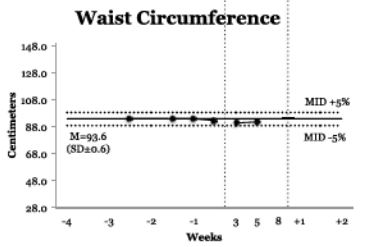
Level	Changed
Effect Size	6.5
Trend	Decreasing
Variability	Stable
Immediacy	Not applicable
Overlap	Absent
Anomalies	Absent
Notation	+



Level	Changed
Effect Size	-1.5
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	Some
Anomalies	Absent
Notation	o



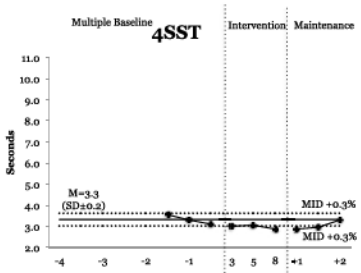
Level	Unchanged
Effect Size	-0.8
Trend	Increasing
Variability	Variable
Immediacy	Not applicable
Overlap	Much
Anomalies	Week -3
Notation	+



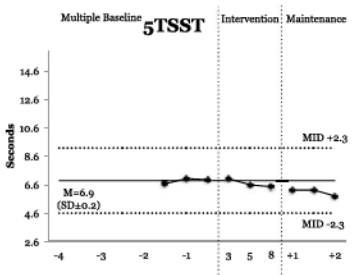
Level	Changed
Effect Size	3.6
Trend	Absent
Variability	Variable
Immediacy	Not applicable
Overlap	None
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

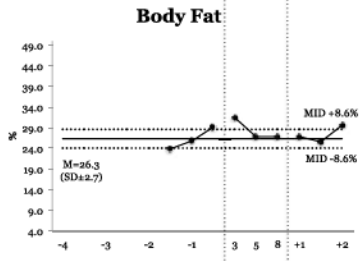
Appendix 38: Visual analysis for case 22



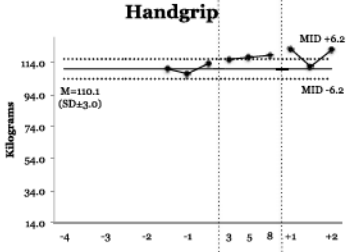
Level	Changed
Effect Size	1.4
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



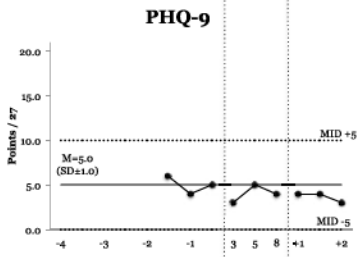
Level	Changed
Effect Size	2.5
Trend	Decreasing
Variability	Stable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	o



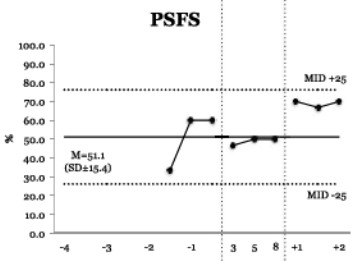
Level	Unchanged
Effect Size	-0.6
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Week 3, +2
Notation	o



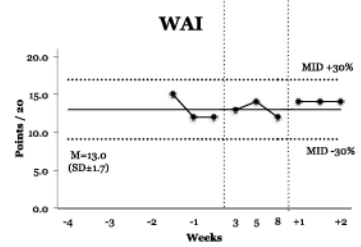
Level	Changed
Effect Size	-2.6
Trend	Increasing
Variability	Stable
Immediacy	Present
Overlap	Some
Anomalies	Between 8,+2
Notation	+



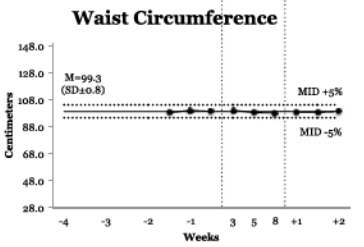
Level	Changed
Effect Size	1.2
Trend	Absent
Variability	Stable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



Level	Unchanged
Effect Size	-0.5
Trend	Increasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	o



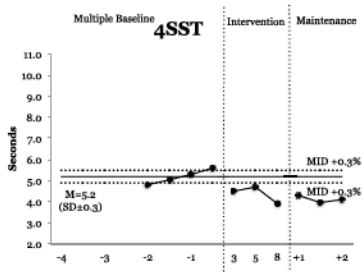
Level	Unchanged
Effect Size	-0.3
Trend	Absent
Variability	Stable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



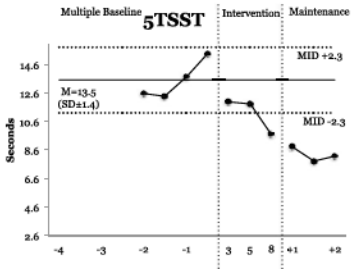
Level	Unchanged
Effect Size	0.6
Trend	Absent
Variability	Stable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3

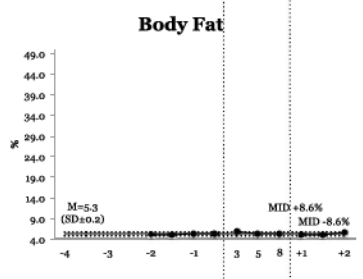
Appendix 39: Visual analysis for case 23



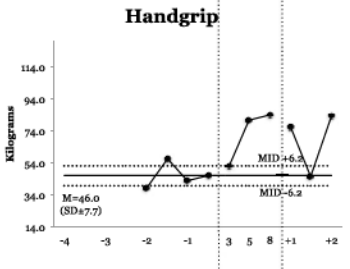
Level	Changed
Effect Size	2.7
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	+



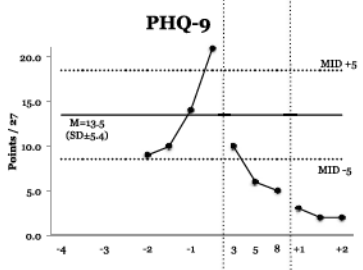
Level	Changed
Effect Size	2.8
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	None
Anomalies	Absent
Notation	+



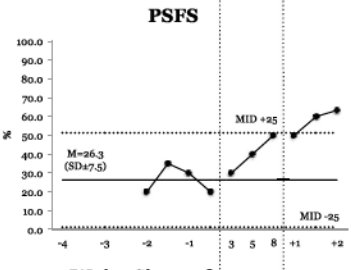
Level	Unchanged
Effect Size	-0.7
Trend	Absent
Variability	Stable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o



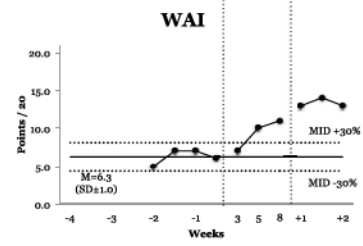
Level	Changed
Effect Size	-3.1
Trend	Increasing
Variability	Variable
Immediacy	Absent
Overlap	Some
Anomalies	Between +1,+2
Notation	+



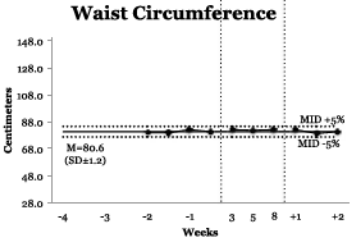
Level	Changed
Effect Size	1.6
Trend	Decreasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Between -1 and 3
Notation	+



Level	Changed
Effect Size	-3.0
Trend	Increasing
Variability	Variable
Immediacy	Absent
Overlap	Some
Anomalies	Absent
Notation	+



Level	Changed
Effect Size	-5.3
Trend	Increasing
Variability	Variable
Immediacy	Present
Overlap	Some
Anomalies	Absent
Notation	+



Level	Unchanged
Effect Size	-0.7
Trend	Absent
Variability	Variable
Immediacy	Absent
Overlap	Much
Anomalies	Absent
Notation	o

Legend: 4SST = 4 Squares Step Test, 5TSST = 5 Times Sit to Stand Test, PHQ-9: Patient Health Questionnaire-9 items, PSFS = Patient-Specific Functional Scale, WAI = Work Ability Index (abridged)
M = Mean, SD = Standard Deviation, MID = Minimally Important Difference, + = Improvement, o = No change/ambiguous, - = deterioration
Examplar of analysis can be found with case #3