

Exercise for HD



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4th Annual HDSA Convention

2nd year Presenter

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Graduated University of North Florida with Doctoral Degree in Physical Therapy 2012

Graduated University of North Florida with Bachelor's Degree in Athletic Training 2009



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HDSA encourages all attendees to consult with their primary care provider, neurologist or other healthcare provider about any advice, exercise, medication, treatment, nutritional supplement or regimen that may have been mentioned as part of any presentation.

Presenter Disclosures

Dr. Chris Lamb

The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

No relationships to disclose
or list



Huntington's Disease
Society of America

Outline of Presentation

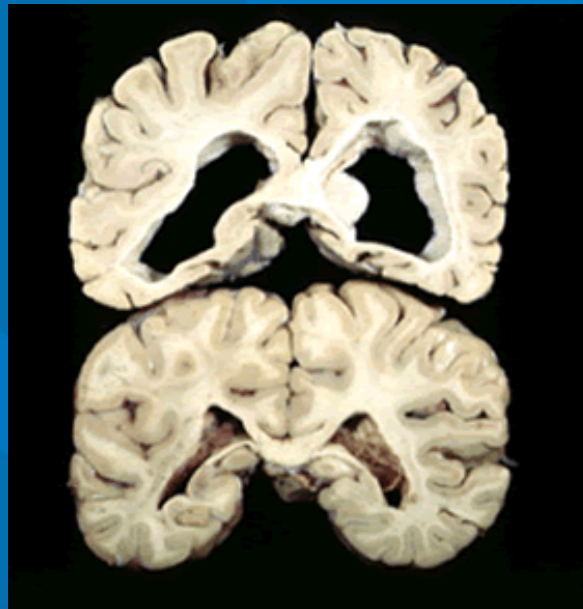
- Role of Physical Therapist in Huntington's Disease.
- Role of exercise in Huntington's Disease.
- Lab session for exercises

Summary of Impairments and Activity Limitations Treated by Physical Therapist in Huntington's Disease (HD)

- Gait and balance training to prevent falls.
- Aerobic capacity and strength training.
- Joint range of motion.
- Respiratory function.
- Transfers/Mobility.
- Wheelchair prescription and training.
- Relaxation.
- Dystonia Management.
- Prevent of contractures.
- Prescription of safety equipment.
- Care giver education.
- Postural Training
- Environmental Alterations

Huntington's Disease During the Four Stages

- Four stages consist of Pre-Onset Stage, Early Stage Onset, Mid stage, and Late stage.



The human brain, showing the impact of HD on brain structure in the basal ganglia region of a person with HD (top) and a normal brain (bottom).

<http://kobiljak.msu.edu>

Pre-Onset Stage of Huntington's Disease

focus of Physical Therapy

- The stage at which the person has no motor and cognitive sign and symptoms.
- Aerobic capacity and strength training.
- Respiratory function.
- Relaxation.
- Care giver education.
- Postural Training.
- Balance training.
- Developing a exercise program focused for HD related impairments for the present and future.

Levels of Evidence for the Research



Levels are 1-9.
Level 1 is the best level and
level 9 is the worst level.

SUNY Downstate Medical Center. Medical
Research Library of Brooklyn. Evidence Based
Medicine Course. A Guide to Research
Methods: The Evidence Pyramid.

The Evidence of Exercise in Huntington's Disease

Potter MC, Yuan C, Ottenritter C, Mughal M, Praag H. Exercise is not beneficial and may accelerate symptom onset in a mouse model of Huntington's Disease. PLOF Currentts Huntington Disease. 2010 Dec 7, Edition 1.

- Level 8 Animal research model. (Low level)
- HD running mice demonstrated earlier motor symptom onset, but lifespan was the same.
- Running was voluntary on running wheel.
- Good take away from article is too much exercise in HD population could be counter-productive.

The Evidence of Exercise in Huntington's Disease

- Zinzi P, Salmaso D, Grandis RD, Graziani G, Maceroni S, Bentivoglio A, Zappata P, Fontali M, and Jacopini G. Effects of an intensive rehabilitation programme on patients with Huntington's Disease: a pilot study. Clin Rehabil 2007; 21; 603.
- Level 4 Case Series. (Human Study)
- Investigated the effects of intensive rehabilitation programme on individuals affected by HD in early to mid stage of the disease.
- Patient's admitted to rehabilitation for 3 weeks for 3 times a year over 2 years. Patient's intensive regimen for 8 hours a day for Mon-Fri and 4 hours on Saturday. Sunday was rest day. Treatment intervention included respiratory exercises, speech therapy, physical and occupational therapy, and cognitive exercises.
- Patient's demonstrated highly significant improvements of motor performance, daily life activities, and no motor declines over two years.

The Evidence of Exercise in Huntington's Disease

- Quinn L, Rao A. Physical Therapy for People with Huntington's Disease: Current Perspectives and Case Report. Neurology Report 2002; 26; 3; 145-153.
- Level 6 Evidence. (Human Trail).
- 49 year old male with HD participated in a 14 week exercise program that consisted of exercises of balance, postural, coordination, flexibility, and gait training.
- Patient's walking speed increased, balance scores improved, Unified Huntington's Disease Rating Scale total motor score decreased, and disability score decreased.

The Evidence of Exercise in Huntington's Disease

- Harrison DJ, Busse M, Openshaw R, Rosser AE, Dunnett SB, Brooks SP. Exercise Attenuates Neuropathology and has Greater Benefit on Cognitive than Motor Deficits in the R6/1 Huntington's Disease Mouse Model. *Experimental Neurology* 2013; 248; 457-469.
- Level 8 Animal Model.
- Determined exercise improved walking and decreased the progression of cognitive dysfunction.

The Evidence of Exercise in Huntington's Disease

- Kloos AD, Fritz NE, Kostyk SK, Yound GS, Kegelmeyer DA. Video game play (Dance Dance Revolution) as a potential exercise therapy in Huntington's disease: a controlled clinical trial. Clin Rehabil November 2013 vol. 27 no. 11 972-982.
- Level 4 Case Series. (Human Study)
- Participants played the Dance Dance Revolution game with supervision and the handheld game without supervision for 45 minutes, two days per week for six weeks.
- Mild balance improvements.
- Dance Dance Revolution appears to high compliance and motivation.

The Evidence of Exercise in Huntington's Disease

- Rottensteiner M, Leskinen T, Niskanen E, Aaltonen S, Mutikainen S, Wikgren J, Heikkila K, Kovanen V, Kainulainen H, Kaprio J, Tarkka IM, Kujala UM. Physical activity, fitness, glucose homeostasis, and brain morphology in twins. *Med Sci Sports Exerc.* 2015 Mar; 47(3): 509-18.
- Identical twins in Finland who shared the same sports and other physical activities as youngsters but different exercise habits as adults soon developed quite different bodies and brains.
- Sedentary twins had lower endurance capacities, higher body fat percentages, and signs of insulin resistance, signaling the onset of metabolic problems.
- Twins' brains also were unlike. The active twins had significantly more grey matter than the sedentary twins, especially in areas of the brain involved in motor control and coordination.

The Evidence of Exercise in Huntington's Disease

- Clark D, Danzl M, Ulanowski E. Development of a community-based exercise program for people diagnosed and at-risk for Huntington's disease: A clinical report. 2016 Apr; 32(3): 232-239.
- Program Design: Based on the literature, clinical expertise and patient values, the program was designed to include four key features:
 - (1) community-based group format for individuals with HD, caregivers, and those at-risk for HD
 - (2) individualized prescription within the group
 - (3) circuit training
 - (4) use of outcome measures

The Evidence of Exercise in Huntington's Disease

- Rollnik, J.D. Do Huntington's Disease Patients Benefit From Multidisciplinary Inpatient Rehabilitation?(2015) Int J Neurol Brain Disord 2(1): 1- 5.

Study	n	Sample	Intervention	Results
Binswanger, 1980 ^[19]	5	Outpatients	Home physiotherapy (focus: muscle weakness, range of movement, gait, breathing) 60 min twice a week for 4 weeks Weekly physiotherapy and occupational therapy over 12 months, focusing on mobility, balance, coordination, contracture prevention, social interaction	Objective outcome measurements not reported, subjective improvements in alertness and balance
Lavers, 1981 ^[20]	6	Late-stage patients on a long-term care psychiatric ward	Weekly outpatient physical therapy program for 3 months (45 min), followed by three monthly sessions, designed to be done at home between therapy sessions with no assistance necessary	Objective outcome measurements not reported, 2 patients gained body weight
Peacock, 1987 ^[21]	10	Early to mid-stage patients	Hydrotherapy (gentle exercises in water supervised by a physiotherapist), unknown period	Objective outcome measurements not reported, "all patients improved"
Sheaff, 1990 ^[22]	1	Case Report (severely disabled male)		Objective outcome measurements not reported, "physiotherapy was beneficial"

The Evidence of Exercise in Huntington's Disease

Quinn & Rao, 2002 ^[23]	1	Case Report (49 y old male, living at a home)	Home program (physical therapy) for 14 weeks	Improvement of SF-36, number of falls, walking speed, Berg Balance Scale (+9), UHDRS-TMS (-12)
Bohlen et al., 2013 ^[24]	12	Outpatients with no risk to fall	Physical therapy sessions, twice per week, 60 min for 6 weeks focusing on transfer training, walking, postural stability, motor coordination tasks	Significant improvement of gait parameters (GAITrite®), Timed-„up&go“, Berg Balance Scale
Kloos et al., 2013 ^[25] (RCT)	18	Outpatients, able to walk	2 days per week 45 min „Dance Dance Revolution“ for 6 weeks	Significant improvement of gait parameters (GAITrite®)
Khalil et al., 2013 ^[26] (RCT)	25	Early to mid-stage HD	Exercises at home three times a week for eight weeks using an exercise DVD	Significant improvement of gait speed, balance, function and level of physical activity

The Evidence of Exercise in Huntington's Disease

Reyes et al., 2014 ^[27] (RCT)	18	Outpatients with UHDRS-TMS ≥ 5	6 times a week home-based inspiratory and expiratory (each 5 sets of 5 repetitions) muscle training for 4 months	Significant improvement of maximum inspiratory/expiratory pressures, forced vital capacity, forced 1 s expiratory volume and peak expiratory flow
Quinn et al., 2014 ^[28] (RCT)	30	Mid-stage HD	Task-specific training by physical therapists in participants homes, focusing on walking, sit-to-stand transfers and standing, twice a week for 8 weeks	92% of individual goals were achieved
Metzler-Baddeley, 2014 ^[29]	10	1 preclinical, 9 early to advanced stages of HD	Rhythm exercise over two months	Improvements in executive functions, changes in white matter microstructures (genu of the corpus callosum)
Dawes et al., 2015 ^[30]	30	Outpatients, older than 18 y, able to consent	Once per week gym intervention with support from a physical therapist (20-30 min, stationary cycle), 10 min a day twice a week walking quickly	No adverse events, no significant influence on heart rate

The Evidence of Exercise in Huntington's Disease

Studie	n	Patienten-charakteristika	Intervention	Outcome
Zinzi et al., 2007 ^[38]	40	Early to mid-stage HD inpatients	Respiratory exercises, speech, physical and occupational therapy, cognitive exercise, three week inpatient rehabilitation (repeated up to 3 times per year)	Significant improvement of motor performance and ADL ($p < 0.001$), no motor decline over two years
Thompson et al., 2013 ^[39] (RCT)	20	Early to mid-stage HD outpatients	9-month multidisciplinary rehabilitation program (once weekly 60 min), occupational therapy targeting cognitive deficits (6 months, 60 min per fortnight) and home exercises (6 months, 3 times per week)	Reduction of motor and postural stability deterioration, minor improvements in depression, cognition and quality of life
Piira et al., 2013 ^[40]	37	Early to mid-stage HD inpatients	1 y rehabilitation program (3 admissions of 3 weeks each) focusing on physical exercise, social activities, and group/teaching sessions	Improvements in gait function, balance, physical quality of life, anxiety and depression, BMI; ADL-function remained stable with no significant decline
Ciancarelli et al., 2013 ^[41] ; Ciancarelli et al., 2014 ^[42]	34	HD inpatients (mean BI 77 points)	3-week inpatient intensive multifunctional neurorehabilitation, 2 x 120 min group therapy daily (physical and occupational therapy)	Significant increase of the mean scores of BI, TS, PPT and TFCS ($p < 0.001$), reduction of oxidative stress, parameters of neurodegeneration (Cu/Zn-SOD, NSE)
Cruickshank et al., 2015 ^[43]	15	Outpatients, UHDRS-TMS > 5	9 months once-weekly supervised clinical exercise, thrice-weekly self-directed home based exercise and fortnightly occupational therapy	Significantly increased gray matter volume in the right caudate and bilaterally in the DLPFC, significant improvements in verbal learning and memory (Hopkins)

The Evidence of Exercise in Huntington's Disease

- Plecash A, Coleman A, Leavitt BR (2015) Feasibility and Safety of an Aquatherapy Program in Mid- to Late-Stage Huntington Disease. Int J Neurorehabilitation 2:181.
- Balance, coordination, core stability, functional and task specific training, and ambulation and gait training.
- Each program was developed to span the 30 minute pool session and was progressed as necessary throughout the study.
- Improved mood and quality of life, safe and feasible, improved sleep, and it improved self-reported motor function (or physical conditioning).

Early Onset Stage of Huntington's Disease Focus of Physical Therapy

- The stage at which the person is either diagnosed with motor and/or cognitive sign and symptoms. Very debatable on when the stage actually occurs.
- Gait and balance training to prevent falls in conjunction with Tetrabenazine (Xenazine) if needed.
- Aerobic capacity and strength training.
- Relaxation.
- Prescription of safety equipment if needed.
- Care giver education.
- Postural Training.
- Stair training.

Mid Stage of Huntington's Disease

Focus of Physical Therapy

- Stage where person starts having difficulty with walking, transfers, stair climbing, and falls could start occurring. Keeping person mobile is the goal here. Usually when the person is referred to Physical Therapy.
- Gait and balance training to prevent falls in conjunction with Tetrabenazine (Xenazine) if needed.
- Relaxation.
- Prescription of safety equipment and Wheelchair prescription and training if needed
- Postural Training.
- Stair training and Environmental Altercations if needed
- Joint range of motion, Dystonia Management, Prevent of contractures.
- Respiratory function.
- Transfers/Mobility with care giver education
- Shorter bouts of exercise with more frequency to prevent stress overload.

The Evidence of Physical Therapy in Huntington's Disease

- Busse ME, Khalil H, Quinn L, Rosser AE. Physical Therapy Intervention for People with Huntington Disease. Physical Therapy 2008. 88; 7; 820-831.
- Determined Physical Therapy is underutilized in the early stages and Mid stage is when patient's are referred to Physical Therapy.

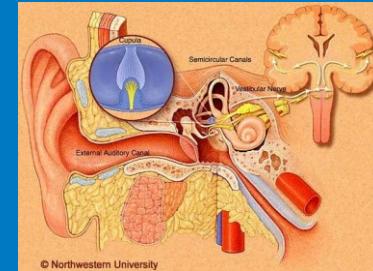
Late Stage of Huntington's Disease

Focus of Physical Therapy

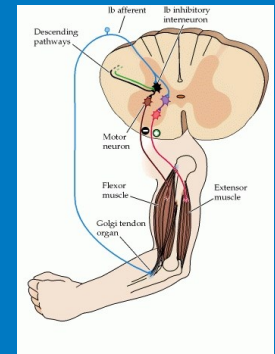
- Stage at which the person has much difficulty getting out of bed, walking, and caring for themselves. Fall prevention is the main goal at this point.
- Protecting the patient.
- Relaxation.
- Environmental Alterations if needed
- Joint range of motion, Dystonia Management, Prevent of contractures.
- Respiratory function.
- Transfers/Mobility with care giver education
- Shorter bouts of exercise with more frequency to prevent stress overload.

3 Balance Systems

- Vestibular System: sensory receptors of the inner ear.



- Somatosensory System: sensory information from the skin, muscles, and joints.



- Visual System: sensory receptors in the retina are called rods and cones



How the Physical Therapist Trains Canceling the Vestibular System

- Covering the ears.
- Headphones.
- Noise.



How the Physical Therapist Trains Canceling the Somatosensory System

- Uneven surface.
- Moving surface.



How the Physical Therapist Trains Canceling the Visual System

- Eye's Closed.

- Blind Fold.



- Turn lights off.



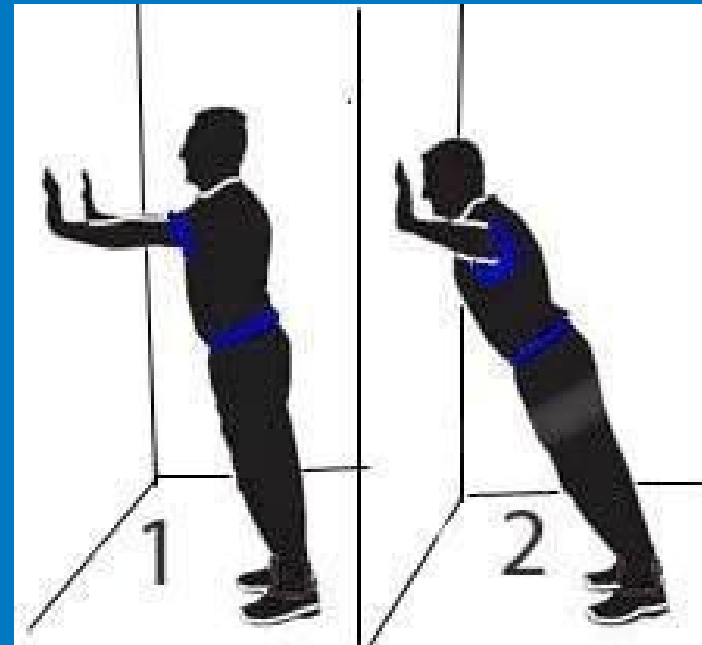
Postural Training

- As HD progresses, postural muscle weaken.
- This includes trunk extensors, neck extensors, core muscles, hip extensors, knee extensors.
*Poor posture is related to increased back pain.
- As the progression continues hand and feet muscles weaken.



Core and Postural Strengthening

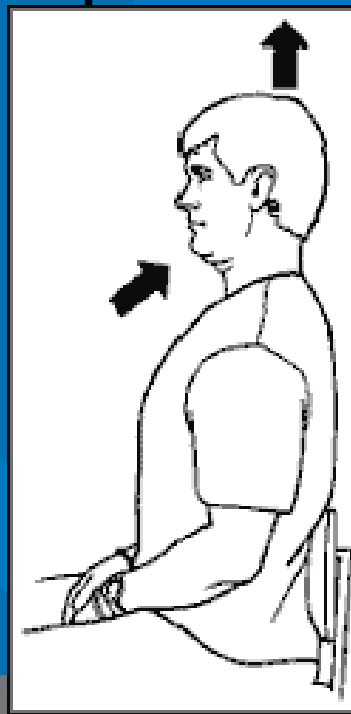
- Scapular Retraction
Wall Push-ups



Core and Postural Strengthening

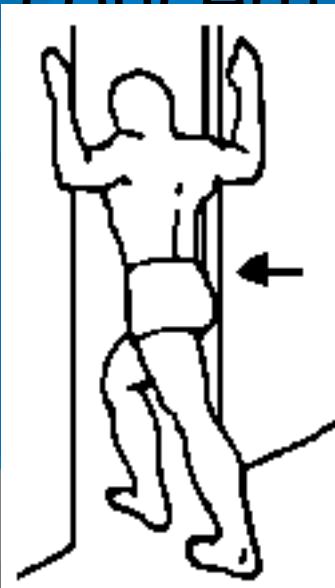
- Sit-stand
Planks and side planks

Chin-tucks



Postural Stretching/ROM Focus for HD

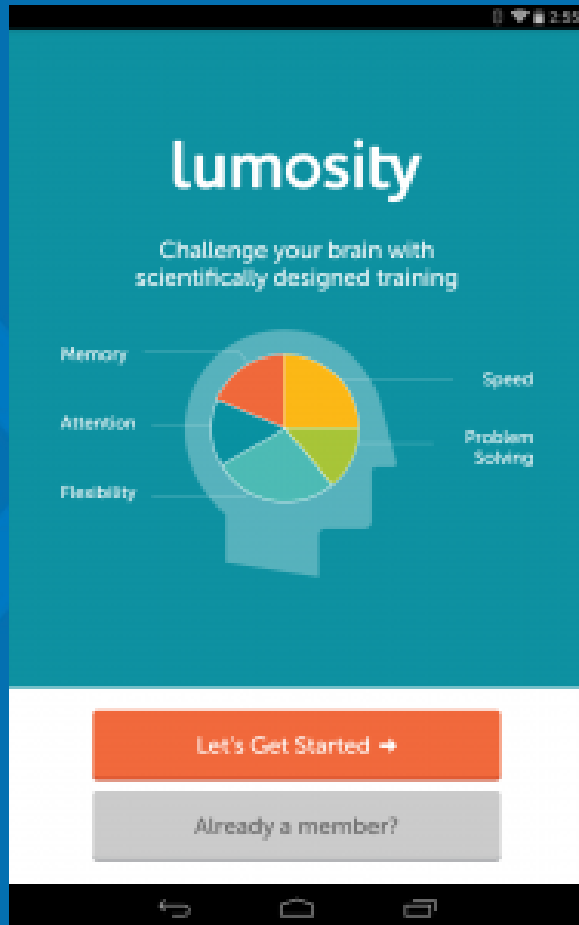
- Doorway stretch for tight pecs
- Hip flexor stretch in standing, if person has enough balance or laying if balance is a concern



Livingston's Disease
Society of America



Memory Training/Task Planning/Task Execution/Problem Solving with Apps



Personal Zen: the app about staying positive and reducing stress and anxiety.

Environment Enrichment Research

- Spires TL, Grote HE, Varshney NK, Cordery PM, Dellen AV, Blakemore C, and Hannan AJ. Environmental Enrichment Rescues Protein Deficits in a Mouse Model of Huntington's Disease, Indicating a Possible Disease Mechanism.
- Used Environmental Enrichment, which mice were exposed to nontoxic objects placed in the home cage that were changed every 2 days. Objects consisted of small cardboard boxes, small open wooden boxes, cylindrical cardboard tunnels, and folded sheets of paper.
- Mice had delays in motor symptoms, increased brain weight, and rescues specific protein deficits.
- Maybe long walks on beaches/parks, site seeing, and etc maybe beneficial vs sedentary lifestyle.

Citations

- 1 Potter MC, Yuan C, Ottenritter C, Mughal M, Praag H. Exercise is not beneficial and may accelerate symptom onset in a mouse model of Huntington's Disease. PLOF Currentts Huntington Disease. 2010 Dec 7, Edition 1
- 2 Zinzi P, Salmaso D, Grandis RD, Graziani G, Maceroni S, Bentivoglio A, Zappata P, Fontali M, and Jacopini G. Effects of an intensive rehabilitation programme on patients with Huntington's Disease: a pilot study. Clin Rehabil 2007; 21; 603.
- 3 Quinn L, Rao A. Physical Therapy for People with Huntington's Disease: Current Perspectives and Case Report. Neurology Report 2002; 26; 3; 145-153.
- 4 Harrison DJ, Busse M, Openshaw R, Rosser AE, Dunnett SB, Brooks SP. Exercise Attenuates Neuropathology and has Greater Benefit on Cognitive than Motor Deficits in the R6/1 Huntington's Disease Mouse Model. Experimental Neurology 2013; 248; 457-469.
- 5 Busse ME, Khalil H, Quinn L, Rosser AE. Physical Therapy Intervention for People with Huntington Disease. Physical Therapy 2008. 88; 7; 820-831.
- 6 Spires TL, Grote HE, Varshney NK, Cordery PM, Dellen AV, Blakemore C, and Hannan AJ. Environmental Enrichment Rescues Protein Deficits in a Mouse Model of Huntington's Disease, Indicating a Possible Disease Mechanism.
- 7 Kloos AD, Fritz NE, Kostyk SK, Yound GS, Kegelmeyer DA. Video game play (Dance Dance Revolution) as a potential exercise therapy in Huntington's disease: a controlled clinical trial. Clin Rehabil November 2013 vol. 27 no. 11 972-982.
- 8 Rottensteiner M, Leskinen T, Niskanen E, Aaltonen S, Mutikainen S, Wikgren J, Heikkila K, Kovanen V, Kainulainen H, Kaprio J, Tarkka IM, Kujala UM. Physical activity, fitness, glucose homeostatis, and brain morphology in twins. Med Sci Sports Exerc. 2015 Mar; 47(3): 509-18.
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- 10 Rollnik, J.D. Do Huntington's Disease Patients Benefit From Multidisciplinary Inpatient Rehabilitation?(2015) Int J Neurol Brain Disord 2(1): 1- 5.
- 11 Plecash A, Coleman A, Leavitt BR (2015) Feasibility and Safety of an Aquatherapy Program in Mid- to Late-Stage Huntington Disease. Int J Neurorehabilitation 2:181.