

Strength Training Across Generations



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Disclosures

*None

Agenda

- Older Adult & Master's Athletes
- Adaptive Athletes
- The Pregnant & Postpartum Athlete
- Youth Athletes

Older Adult & Masters' Athletes



What Changes with Age

System	Change	Clinical Application
Cardiovascular	↓ Max HR ↓ Stroke Volume ↓ Cardiac Output ↓ Sensitivity of Baroreceptors ↑ Systolic BP	Slower response to exercise Less able to tolerate higher intensities RPE useful
Pulmonary	↓ Strength expiratory muscles ↑ Chest stiffness	Work of breathing increases More resistance when breathing heavy
Immune System	↓ # WBCs	More likely to get sick
Reproductive System	↓ release of estrogen and progesterone (female) ↓ testosterone (male)	Women at risk for OP ↑ Risk of UTI

ACSM 2009

The Cost of Weakness

Health Care Costs Associated With Muscle Weakness: A UK Population-Based Estimate

Rafael Pinedo-Villanueva¹ · Leo D. Westbury² · Holly E. Syddall² · Maria T. Sanchez-Santos¹ · Elaine M. Dennison^{2,3} · Sian M. Robinson^{2,4} · Cyrus Cooper^{2,4,5}

2018

- 442 subjects aged 71-80
- Assessed muscle weakness via grip strength
- Correlated to costs associated with subjects healthcare system visits/costs
- 11% had clinical muscular weakness
- Those with muscular weakness use **250% more healthcare dollars**
- Excess costs associated healthcare utilization due to muscular weakness estimated at 3.25 billion US Dollars per year
- **Being Weak is Expensive!**

Level Up Care for the Older Adult

A novel weight-bearing strengthening program during rehabilitation of older people is feasible and improves standing up more than a non-weight-bearing strengthening program: a randomised trial

Lynette Olivetti¹, Karl Schurr², Catherine Sherrington^{3,4}, Geraldine Wallbank², Patricia Pamphlett², Marcella Mun-San Kwan⁴ and Robert D Herbert³

- N=88 (inpatient older adults, mean age: 82)
- Two week intervention
 - Weight-bearing group: lateral step ups, sit to stands, forward step ups
 - Non-weight-bearing group: seated pulley exercise circuit (knee extension, knee flexion, hip extension, hip abduction)
- Statistically significant improvement in hip extensor strength and ability to sit to stand out of chair in weight-bearing group
- **SHOCKING**



“Normal Aging” or Deconditioning?

Endurance exercise performance in Masters athletes: age-associated changes and underlying physiological mechanisms

Hirofumi Tanaka¹ and Douglas R. Seals²

- Changes seem to be due more towards deconditioning rather than age
- Fiber type changes are very small in trained older adults than non-trained young adults

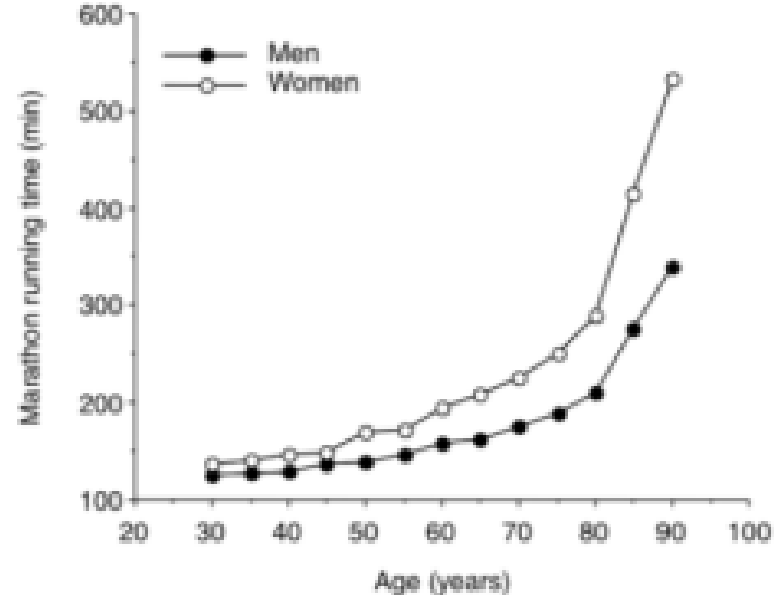


Figure 1

Changes in men's and women's marathon running times with advancing age (from USA Track & Field and World Masters Athletics).

The LIFTMOR Trial

- All subjects post-menopausal with diagnosed osteoporosis & osteopenia via DEXA
- Performed 5x5 of: deadlift, overhead press, back squat and jumping chin ups at 80-85% 1RM
- Control group: low intensity (max 3kg load)
- Heavy lifting group had superior outcomes of lumbar spine and femoral neck BMD, cortical bone thickness, bone height and increases in all functional performance measures

CLINICAL TRIAL

JBMR[®]

High-Intensity Resistance and Impact Training Improves Bone Mineral Density and Physical Function in Postmenopausal Women With Osteopenia and Osteoporosis: The LIFTMOR Randomized Controlled Trial

Steven L. Watson,^{1,2} Benjamin K. Weeks,^{1,2} Lisa J. Weis,³ Amy T. Harding,^{1,2} Sean A. Horan,^{1,2} and Belinda R. Beck^{1,2,3}

Round 2 - The LIFTMOR Trial - Male

Open Access

Protocol

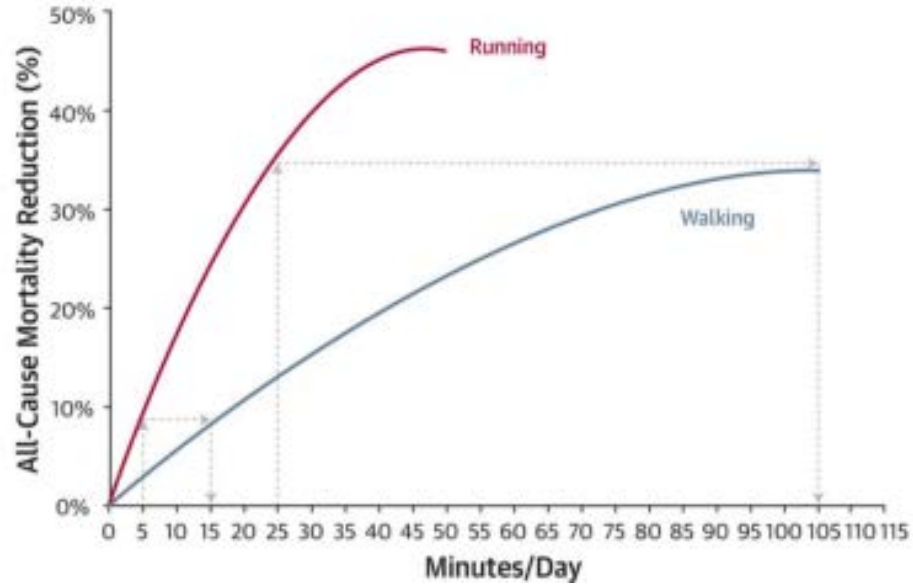
BMJ Open The LIFTMOR-M (Lifting Intervention For Training Muscle and Osteoporosis Rehabilitation for Men) trial: protocol for a semirandomised controlled trial of supervised targeted exercise to reduce risk of osteoporotic fracture in older men with low bone mass

Amy T Harding,^{1,2} Benjamin K Weeks,^{1,2} Steven L Watson,^{1,2} Belinda R Beck^{1,2,3}

- Men with diagnosed osteoporosis and osteopenia
- 5x5 deadlift, overhead press, back squat, jumping chin ups at 80-85% 1RM
- Compared to low load control and machine strengthening group
- Heavy group had superior outcomes: femoral neck, calcaneus and lumbar spine BMD, body composition, TUG, 5x sit to stand, lumbar extension strength
- Heavy group: 78% adherence and compliance
- More adverse health reactions in machine group

Intensity Matters

Chi Pang Wen et al., 2014







Adaptive Athletes

Use It or Lose It

Size and blood flow of central and peripheral arteries
in highly trained able-bodied and disabled athletes

M. Huonker, A. Schmid, A. Schmidt-Trucksäß, D. Grathwohl, and J. Keult

*Medical University Hospital Freiburg, Department of Prevention,
Rehabilitation and Sportsmedicine, D-79106 Freiburg, Germany*

Submitted 9 July 2001; accepted in final form 18 October 2002

- Comparison of blood flow at different sites between elite tennis players & road cyclists, paraplegic athletes and sedentary controls
- Femoral artery flow similar between elite road cyclists and BKA athletes who reported regular exercise of residual limb
- Paraplegic athletes demonstrated large vessel diameter and vessel cross-sectional areas than sedentary controls
- No difference in vessel diameters or cross-sectional areas between active groups

Psychological > Physiological?

Self-Concept of Young People with Physical Disabilities: does integration play a role?

SYLVIE MRUG*

Department of Psychology, Purdue University, 1364 Psychological Sciences Building,
West Lafayette, IN 47907, USA

JAN L. WALLANDER

University of Alabama at Birmingham, Birmingham, AL 35294, USA

Psychological Reports, 1985, 56, 923-929. © Psychological Reports 1985

PSYCHOLOGICAL IMPACT OF SPORT ON DISABLED ATHLETES¹

PAUL M. VALLIANT¹, IRENE BEZELBYK,
LORNE DALEY,² AND MARJATTA E. ASU²

¹Laurentian University

THE SELF-PERCEPTION OF ATHLETES WITH DISABILITY

Goran Kasum¹, Marija Mladenović²

¹University of Belgrade, Faculty of Sport and Physical Education, Serbia

²Physical Education & Sports Management, Belgrade, Serbia

Perceptual and Motor Skills, 1990, 70, 1093-1098. © Perceptual and Motor Skills 1990

SELF-CONCEPTS OF DISABLED YOUTH ATHLETES¹

CLAUDINE SHERRILL, MARILYN HINSON, BARBARA GENCH,
SUSAN O. KENNEDY, AND LESLIE LOW

¹East Women's University

Comparison of Body Image in Male Disabled Athletes with both Disabled and Non-disabled Non-athletes

Ali Zarei¹ and Abdollah Ghasemi²

¹Department of Physical Education, Payame Noor University, Iran, Po Box: 19395-3697

²Science and Research Branch, Islamic Azad University, Tehran, Iran

- The more integrated the individual, the more likely to report positive self-views, positive world view, less behavioral issues
- Adaptive athletes that participate in sport are 811% more likely to belong to social groups
- Adaptive athletes have significantly higher self-esteem, life satisfaction, happiness, attain higher levels of education and have lower suicide rates than disabled non-athletes

Pregnant & Postpartum Athletes



The Pregnant Athlete

- First things first: High quality research in this field is *emerging*
 - Would love to see systematic reviews with meta-analysis in this population but as of now it does not exist yet
- It is OKAY for pregnant women to exercise from conception to full-term
- Cardiac output increases 30-50%
 - Heart rate spikes quicker
- Relaxin hormone increases ligamentous laxity
 - Greater range of motion - but need to control it
 - Deep, diaphragmatic breathing becomes harder - baby increases oxygen consumption by 30%
 - Pregnant athletes trend towards short, shallow chest breathing
- Baby needs fuel!
 - Calorie intake needs to increase 250-420 calories/day

Musculoskeletal Pregnancy Changes

- Changes in pelvic, hip and lumbar region
 - Increased complaints of low back pain, hip pain, and SI joint pain
 - Joint pain comes and goes with pregnancy
- Natural separation of abdominal wall (diastasis recti)
 - Occurs in every woman - unavoidable - rest will not prevent this
 - Begins 2nd trimester
 - Management of separation is crucial in mitigating symptom development and facilitating postpartum recovery

Pregnancy & Exercise Modification

- First trimester (1-14 weeks)
 - Usually no modifications or restrictions
 - Most women feel ill and are not exercising much anyway
 - **Pain, belly heaviness, or leakage** are indicators that intensity, weight, and/or volume need to reduce during exercise

Pregnancy & Exercise Modification

- 2nd trimester (14-28 weeks)
 - **No more valsalva maneuver** - weight should be subthreshold and be able to breath through reps
 - **Avoid contact with belly** - Switch from bar workouts to dumbbell/kettlebells
 - **Avoid ground contact with belly**
 - **Monitor for discomfort at bottom of squat** - Hit parallel
 - May feel ok during a workout but will complain of cramping afterwards or next day - avoid this
 - **Jumping** - modify to step ups
 - **Running** - reduce volume/distance if symptomatic
 - **Gymnastics** - Off pull up bars at 20 weeks
 - No full ROM sit ups - Utilize TRX, ring rows, bands, planks
 - Monitor rowing/kettlebell swings for overextension in spine (can increase diastasis recti)
 - Stop at neutral

Pregnancy & Exercise Modification

- 3rd trimester (28-40 weeks)
 - **Weightlifting** - Focus is strictly on technique
 - Utilize elevated surfaces; no need to be lifting from ground
 - **Abdominal work** - No more planking
 - Switch to standing exercises: pallof press outs, DB side bends, hollow holds against wall

- Takeaways
 - This is not a lecture on how to master working with pregnant and postpartum athletes
 - Every single woman is different. Some will need to regress movements very soon into pregnancy, some will be able to remain at a higher level into pregnancy
 - Underserved population and a lot many do not know about

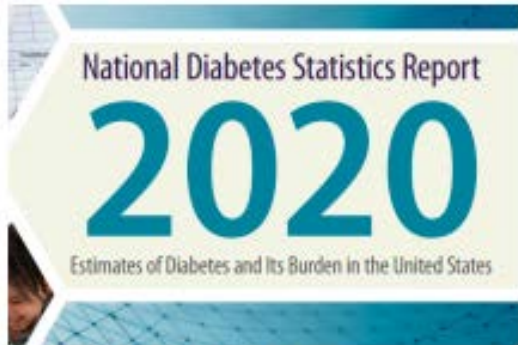


Youth Athletes

Those darn kids...

Obesity and Type 2 Diabetes in Children: Epidemiology and Treatment

Elizabeth R. Pulgaron, PhD and Alan M. Delamater, PhD
Department of Pediatrics, 1601 NW 12th Ave., University of Miami Miller School of Medicine,
Miami, FL 33136.



WJD 5th Anniversary Special Issues (2): Type 2 diabetes

Type 2 diabetes mellitus in children and adolescents

- 33% of US children are overweight, 17% are morbidly obese
 - 300% increase from 1970 (CDC 2020)
- 45% of diabetic children have T2DM (1% in 1990)
 - 21% increase from 2001-2009 (CDC 2020)
- Need lifestyle interventions!

But the growth plates!

- Origin of a myth
 - Research from 1970s or earlier from Japan evaluating physical characteristics of child laborers
 - Children were abnormally short but very active, therefore movement must have stunted their growth
 - No consideration of nutrition or sleep

Should kids lift?

- American Academy of Pediatrics & NSCA - **YES!**
 - Avoid repetitive maximal lifts (1RM-3RM) until Tanner Stage 5 (armpit hair, pubic hair, acne, deepened voice that does not crack)
- Faigenbaum 2009
 - “The acceptance of youth resistance training by medical, fitness and sports organizations **should now be universal**”

Benefits of Adolescent Resistance Training

- Guy and Micheli 2001
 - High-intensity resistance training in adolescent male powerlifters effective at increasing both lumbar spine and whole body bone mineral density
- Faigenbaum 2000
 - “If appropriate training guidelines are followed, regular participation in a youth strength-training program has the potential to increase bone mineral density, improve motor performance skills, enhance sports performance, and better prepare young athletes for the demands of practice and competition.”
- Dahab and McCambridge 2009
 - “Case reports of injuries in youth strength training are almost exclusively associated with misuse of equipment, inappropriate weights, or improper technique which is no different than injuries associated with adult strength training”
 - **Anything done poorly is dangerous**

Summary & Takeaways

- Heavy, higher intensity strength & conditioning exercise is **SAFE** and **APPROPRIATE** for older adults, teens, kids, pregnant & postpartum athletes and adaptive athletes
- Underdosing these populations has led to an drastic increase of chronic disease and pain