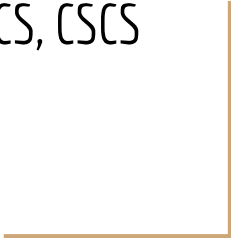




Graded Therapeutic Activity and the Cardiology Patient

Dr. Eldon Graham, DPT, OCS, CSCS



Disclosures:

- No financial ties or disclosures

Introduction of topic

- Etiology/Demographics
- Benefits of Exercise
- ABC's of Exercise Prescription
 - **A**ssessment: Quick Outcome Measures
 - **B**rief Intervention/Prescription
 - **C**ontinued Support
- Closing and Additional Resources



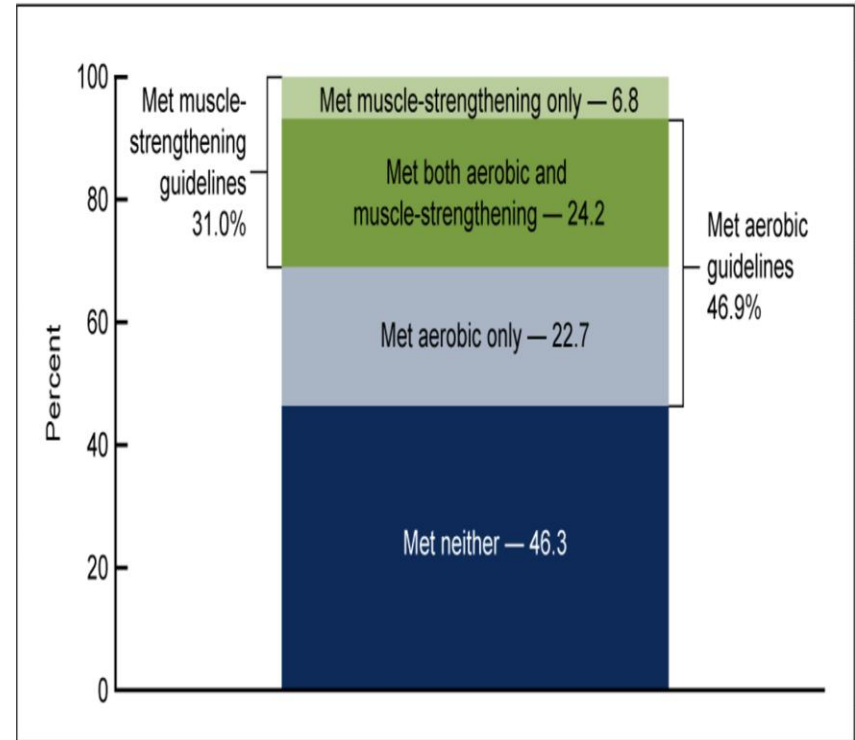
https://stock.adobe.com/search?filters%5Bcontent_type%3Aphoto%5D=1&filters%5Bcontent_type%3Aillustration%5D=1&filters%5Bcontent_type%3Azip_vector%5D=1&filters%5Bcontent_type%3Avideo%5D=1&filters%5Bcontent_type%3Atemplate%5D=1&filters%5Bcontent_type%3A3d%5D=1&filters%5Bcontent_type%3Aimage%5D=1&k=people+running&order=relevance&limit=100&search_page=1&search_type=usertyped&acp=&aco=people+running&get_facets=0&asset_id=251279288

Etiology and Demographics: CVD

- Heart disease is leading cause of death in US
 - 1 death every 34 seconds from CVD
- 919,032 deaths from CVD in 2023 (1 in every 3 deaths)
- 127.9 million US adults (48.6%) had some form of CVD
- 100 million adults are obese (40.3% from 2021-2022)
 - 22 million are severely obese
- Heart disease cost 417.9 billion from 2020-2021
 - *statistics pulled from WHO and AHA

Etiology and Demographics: Exercise

- WHO Recommendations:
 - 150-300 mins of moderate-intensity aerobic physical activity/week
 - Or 75-150 mins of vigorous-intensity aerobic physical activity/week
 - 2 strength days involving all muscle groups 2x/week
- **Adults over 18, only 24.2% met guidelines** for both strength and aerobic activities
- Decreases with age:
 - Age 18-34: 29.4%
 - Age 35-49: 21.6%
 - Age 50-64: 15.3%
- **46.3% did not meet guidelines for either**



Fitness and All-Cause Mortality

Figure 2. Risk-Adjusted All-Cause Mortality

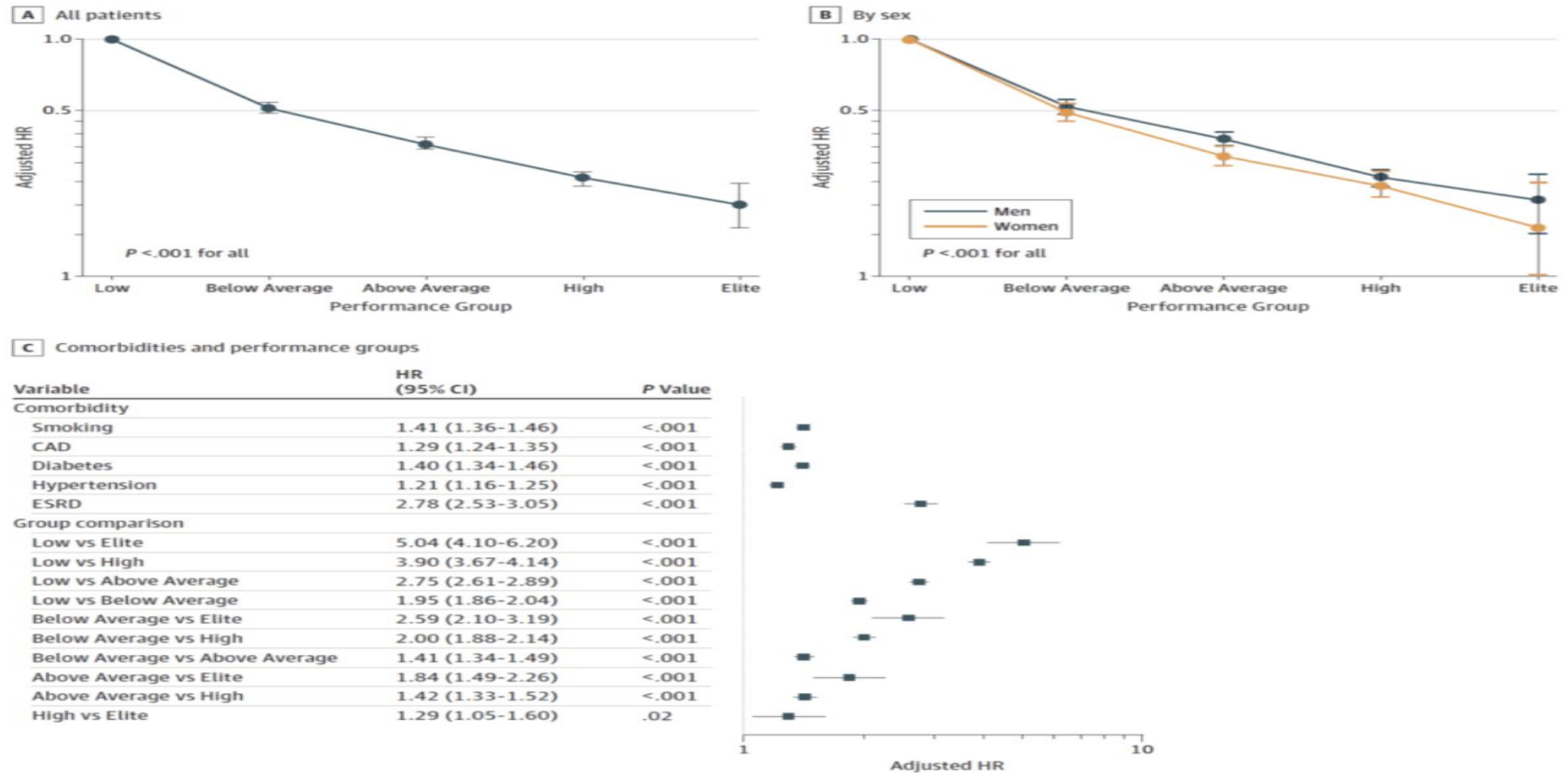


Figure 2. Risk-adjusted all-cause mortality. ([Mandsager et al., 2018](#)).

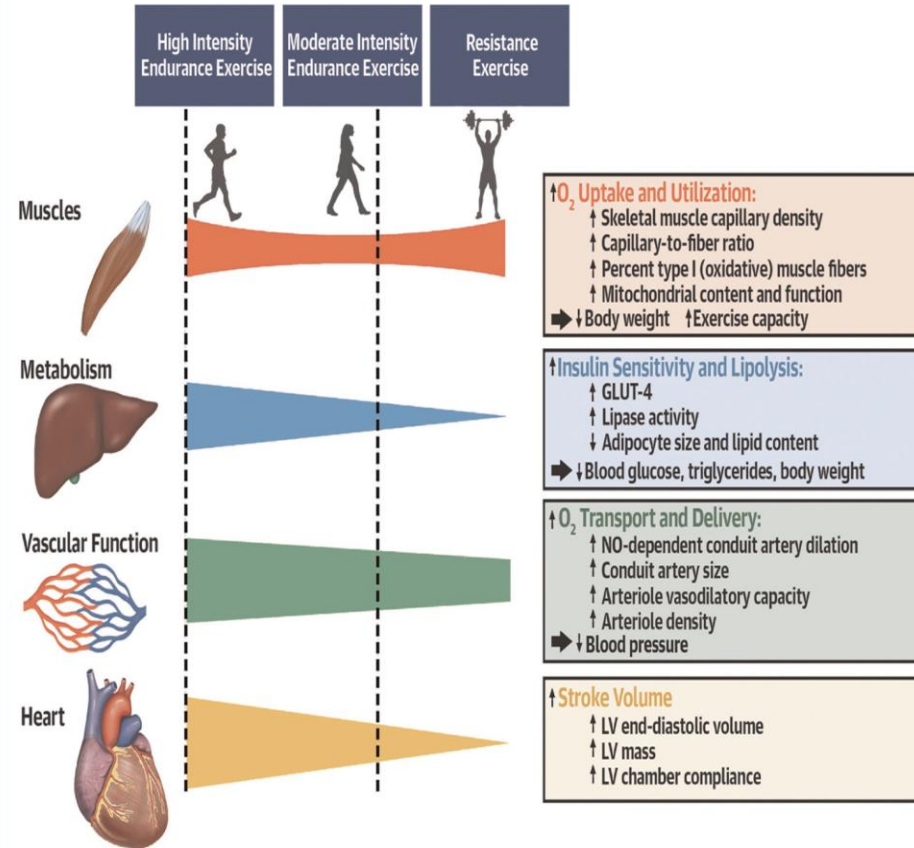
Cardioprotective Benefits of Exercise

Exercise for Primary and Secondary Prevention of Cardiovascular Disease: JACC Focus Seminar 1/4

Wesley J Tucker ¹, Isabel Fegers-Wustrow ², Martin Halle ³, Mark J Haykowsky ⁴, Eugene H Chung ⁵, Jason C Kovacic ⁶

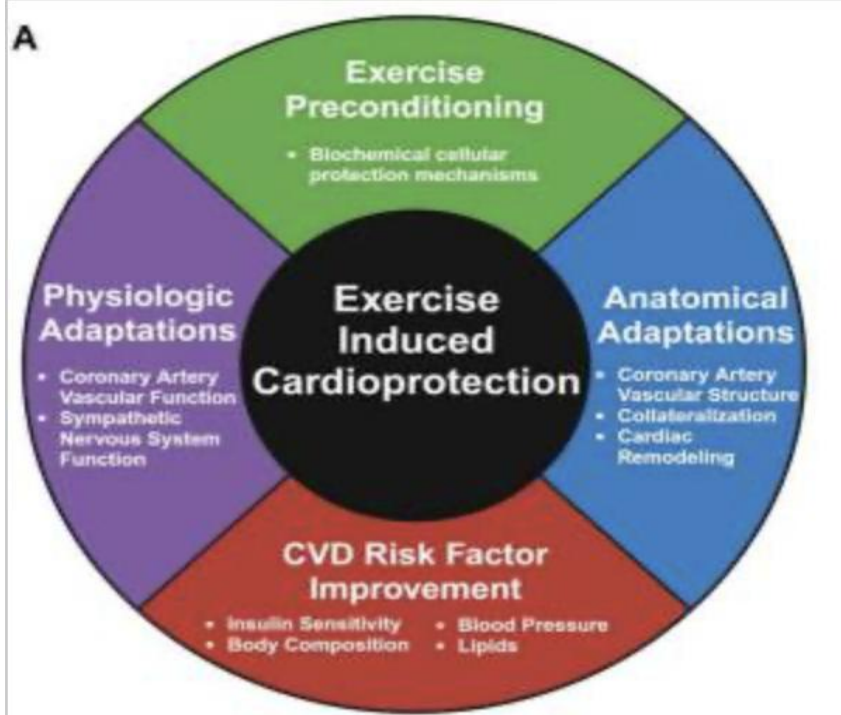
J Am Coll Cardiol. 2022 Sep 13;80(11):1091-1106. doi: 10.1016/j.jacc.2022.07.004.

CENTRAL ILLUSTRATION: Differing Forms of Exercise Trigger Differing Physiological Adaptations



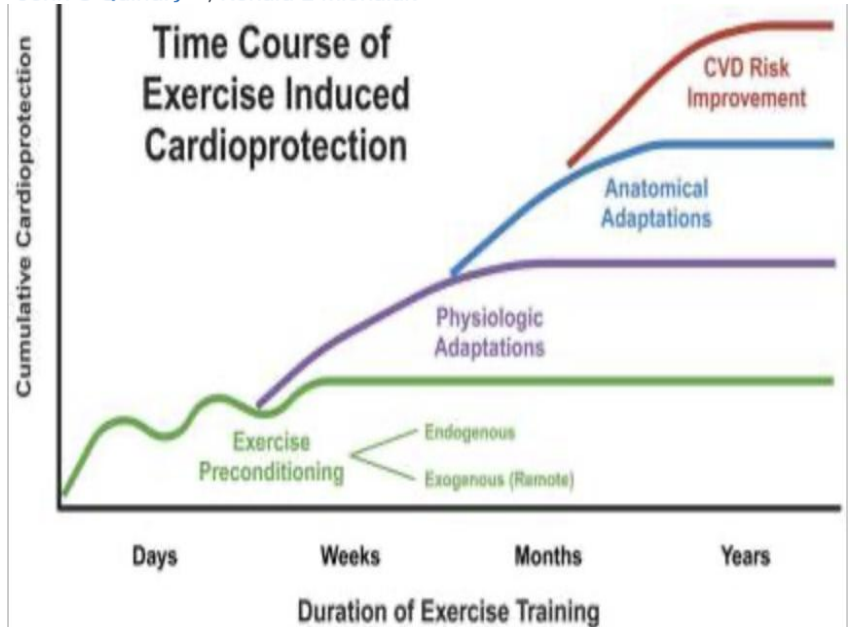
Tucker WJ, et al. J Am Coll Cardiol. 2022;80(11):1091-1106.

Cardioprotective Benefits of Exercise



Exercise-induced cardioprotection: From endogenous to exogenous mechanisms

John C Quindry ¹, Ronald E Michalak ¹



Exercise as Medicine:

- 1) Nearly half of population has CVD, and/or Obesity
- 2) Nearly half of population doesn't meet daily requirements for exercise
- 3) Each quintile of fitness demonstrates significant reduction of all cause mortality
 - a) Up to high levels of fitness
- 4) We should be utilizing exercise as an intervention to help patients climb to the next quartile of fitness

Question: what is enough? Is there too much/too little?

Upper Threshold: Is There a Lethal Dose?

- Van Camp and Peterson study:
 - 167 cardiac rehab programs, 51k patients, 2 million exercise hours
 - 1 cardiac arrest per 112,000 exercise hours
 - 1 acute MI per 300,000 exercise hours
 - 1 fatality per 800,000 exercise hours
 - Dangers are present, but extremely rare
- FITR RCT: 4-week cardiac rehabilitation program:
cardiorespiratory fitness (VO₂) significantly
 - 10% with HIIT
 - 4% with MICT
 - HIIT had higher adherence: 18 of 34 [53%] versus MICT 15 of 37 [41%]
- Wewege systematic review: 2018 JAHA
 - 23 studies, 1117 participants with CAD or heart failure
 - 1 major cardiovascular event per 17,083 training sessions (patient also denied cardioverter-defibrillator implantation before inclusion of study, and happened in first week of training and self-withdrew from study)
 - Conclusion: HIIT shown a relatively low rate of adverse events with patients with CAD or HF
 - Working HR at 88-95% for these studies
 - No significant difference between groups for AE (adverse events P=0.70)

Lower Threshold: Is There Too Little?

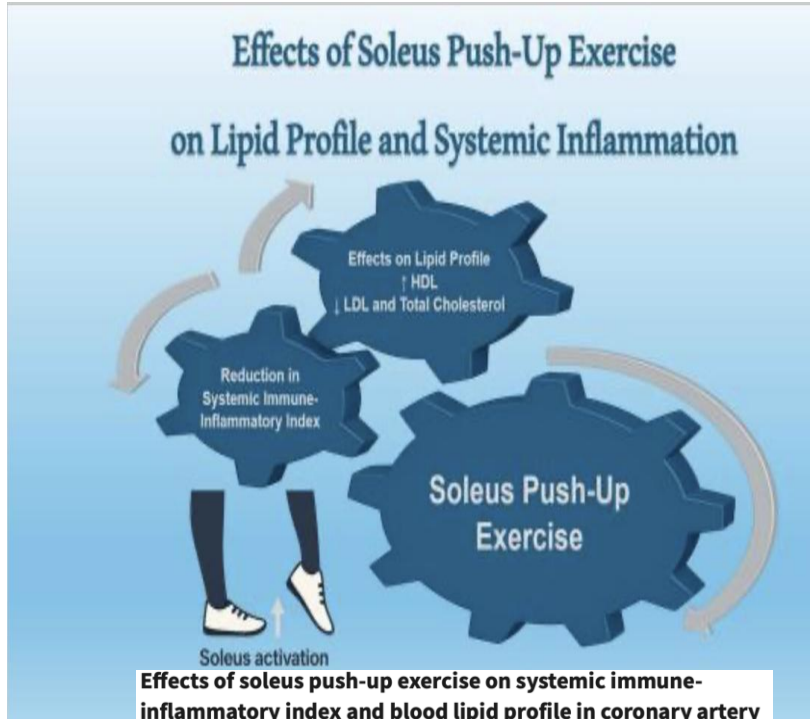


Table 3.

Third-month follow-up parameters of the patients.

	Exercise group (n = 24) (mean ± SD)	Control group (n = 19) (mean ± SD)	P-value
HDL-C	62.3 ± 10.7	41.9 ± 11.2	<.005
LDL-C	56,6 ± 14.7	87.7 ± 33.4	<.005
T.CHOL	150.1 ± 13.2	176.0 ± 41.0	<.005
SII	213.4 ± 12.2	536.26 ± 55.99	<.001

HDL = high-density lipoprotein, LDL = low-density lipoprotein, SII = systemic immune-inflammatory index, SD = standard deviation, T.CHOL = total cholesterol.

Bottom Line: What is Enough? Is There Too Much?

- Effective, either stand-alone or in combo with medication/surgery
- SAFE! (even in high intensity situations with CVD patients)
- Some is better than none, more is better yet (consistency > intensity)

How Do We Prescribe Exercise as Medicine?: ABC

A

Assessment

Risk for participation

Motivation

Self-efficacy

Personal Preference

B

Brief Intervention

Written prescription

Counselling

Frequency

Intensity

Type

Timing

Progression

C

Continued Support

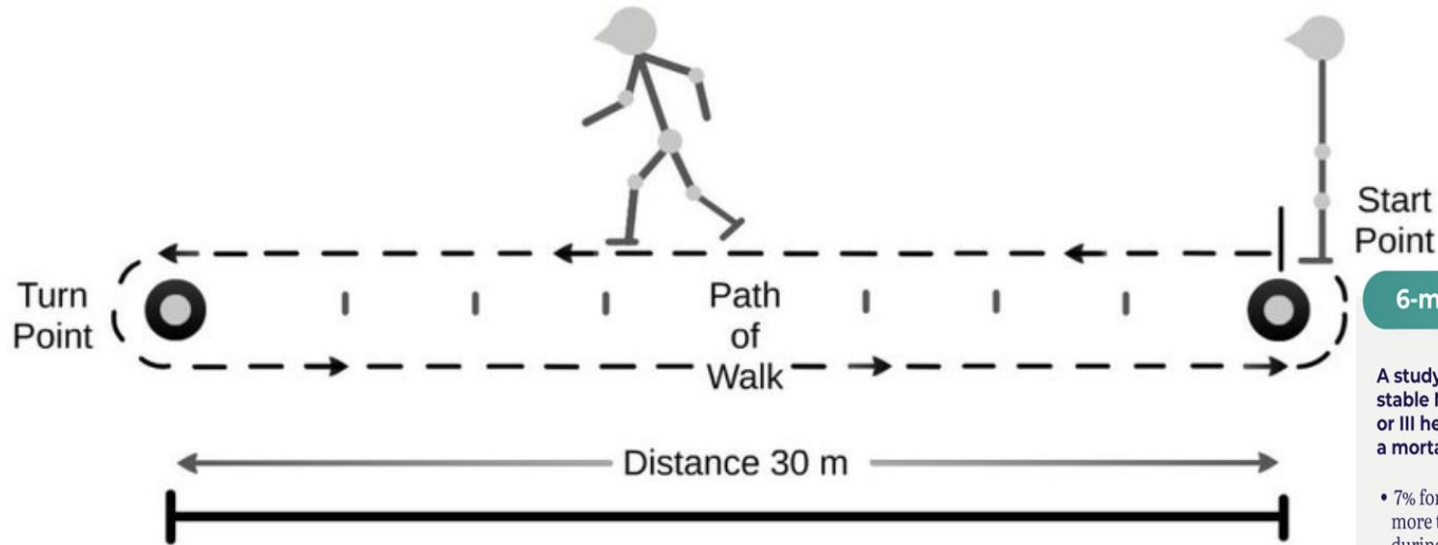
Personalised support from

Doctor/Nurse

Collaboration with other

professionals

Assessment/Outcome Measures: 6MWT



6-minute Walk Test for Heart Failure

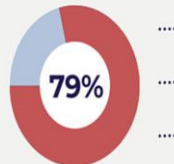
A study of 43 people with stable NYHA functional II or III heart failure reported a mortality rate of:

- 7% for people who walked more than 300 meters during the 6MWT and



300 meters

- 79% for people who walked 300 meters or less, with significantly increased death risk for the second group.



Benavent-Caballer, Vicent. (2016). The effectiveness of exercise interventions and the factors associated with the physical performance in older adults.
<https://www.thecardiologyadvisor.com/ddi/6-minute-walk-test/>

Assessment/Outcome Measures: Sitting-Rise (SRT) Test

Sitting-rising test scores predict cardiovascular and natural causes of deaths in middle-aged and older men and women: a 2024 update

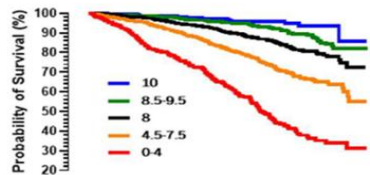
Comparison of 2012 and 2024 studies

Items	2012	2024
Number of individuals	2,002	4,282
Sex of individuals	Men (67.7%)	Men (67.5%)
Age range (years)	51-80	46-75
Death rate (%)	7.9	15.5
Period of data collection	30Jul1998-31Dec2011	30Jul1998-31Dec2023
Median follow-up (years)	6.3	12.2
Grouping of SRT scores for survival analysis	4 groups [0-3; 3.5-5.5; 6-7.5; 8-10]	5 groups [0-4; 4.5-7.5; 8; 8.5-9.5; 10]
Covariates	Age, sex and body mass index	Age, sex and body mass index and clinical variables*
Outcomes	All-cause mortality	Natural (excluding COVID-19 and external causes) and CV causes of mortality

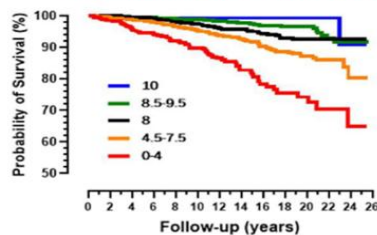


CLINIMEX Exercise cohort

Sitting-Rising Test scores
Natural causes of mortality



Cardiovascular causes of mortality

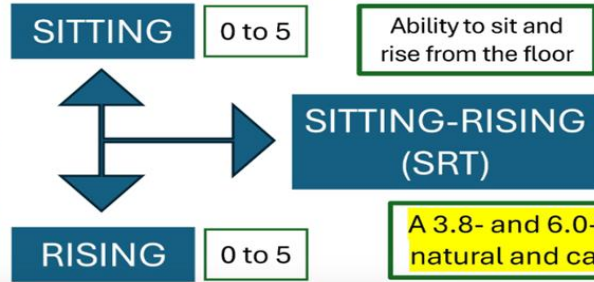


Scoring:

-1 point for each support;
-0.5 point for unsteady execution



the sitting-rising test



0 to 10

Death rates [SRT scores]:

3.7% [10], 11.1% [8] and 42.1% [0-4]

A 3.8- and 6.0-fold higher risk for mortality, respectively, for natural and cardiovascular mortalities for SRT [0-4] vs. [10]

Assessment/Outcome Measures: 30 Second Sit to Stand

Setup:

- Goal: Sit-to-Stand as many times from standard chair as 30 seconds will allow

Table 1. Clinical and Demographics Descriptive Statistics.

	Sufficiently Active (n = 50)	Insufficiently Active (n = 31)	p-values
Age (years)	25.1 ± 3.3	24.8 ± 3.6	0.720
Race, N (percent)	White 39 (78.0) Others 11 (22.0)	White 20 (64.5) Others 11 (35.5)	0.185
Sex, N (percent)	Males 16 (32.0) Females 34 (68.0)	Males 18 (58.1) Females 13 (41.9)	NA
Body Mass (kg)	69.3 ± 14.6	77.7 ± 17.3	0.021
Body Height (m)	1.7 ± 0.1	1.7 ± 0.9	0.122
BMI (kg/m ²)	24.1 ± 4.3	25.9 ± 4.9	0.086
IPAQ Leisure Domain (MET-minute/week)	2297.7 ± 1265.6	444.2 ± 325.1	<0.001
30-CST (Repetitions)	34.0 ± 5.2	31.5 ± 5.5	0.040

Normative Reference Values and Validity for the 30-Second Chair-Stand Test in Healthy Young Adults

Donald H. Lein Jr.^{1 a}, Mansour Alotaibi², Marzouq Almutairi³, Harshvardhan Singh¹

ASSESSMENT

30-Second Chair Stand

Purpose: To test leg strength and endurance
Equipment: A chair with a straight back without arm rests (seat 17" high), and a stopwatch.

NOTE: Stand next to the patient for safety.

① **Instruct the patient:**

1. Sit in the middle of the chair.
2. Place your hands on the opposite shoulder crossed, at the wrists.
3. Keep your feet flat on the floor.
4. Keep your back straight, and keep your arms against your chest.
5. On "Go," rise to a full standing position, then sit back down again.
6. Repeat this for 30 seconds.

② **On the word "Go," begin timing.**

If the patient must use his/her arms to stand, stop the test. Record "0" for the number and score.

③ **Count the number of times the patient comes to a full standing position in 30 seconds.**

If the patient is over halfway to a standing position when 30 seconds have elapsed, count it as a stand.

④ **Record the number of times the patient stands in 30 seconds.**

Number: _____ Score: _____

Patient _____

Date _____

Time _____ ☐ AM ☐ PM



SCORING

Chair Stand Below Average Scores

AGE	MEN	WOMEN
60-64	< 14	< 12
65-69	< 12	< 11
70-74	< 12	< 10
75-79	< 11	< 10
80-84	< 10	< 9
85-89	< 8	< 8
90-94	< 7	< 4

A below average score indicates a risk for falls.

Additional resources can help you screen, assess, and intervene to reduce falls. For more information, visit www.cdc.gov/steadi

 Centers for Disease Control and Prevention
National Center for Injury Prevention and Control

 **STEADI** Stopping Elderly Accidents, Deaths & Injuries

2017

30 Second STS in Healthy Young Adults

Table 1. Clinical and Demographics Descriptive Statistics.

	Sufficiently Active (n = 50)	Insufficiently Active (n = 31)	p-values	Total
Age (years)	25.1 ± 3.3	24.8 ± 3.6	0.720	25.1 ± 3.4
Race, N (percent)	White 39 (78.0) Others 11 (22.0)	White 20 (64.5) Others 11 (35.5)	0.185	White 54 (66.7) Others 27 (33.3)
Sex, N (percent)	Males 16 (32.0) Females 34 (68.0)	Males 18 (58.1) Females 13 (41.9)	NA	Males 34 (42.0) Females 47 (58.0)
Body Mass (kg)	69.3 ± 14.6	77.7 ± 17.3	0.021	72.6 ± 16.1
Body Height (m)	1.7 ± 0.1	1.7 ± 0.9	0.122	1.7 ± 0.1
BMI (kg/m ²)	24.1 ± 4.3	25.9 ± 4.9	0.086	24.8 ± 4.6
IPAQ Leisure Domain (MET-minute/week)	2297.7 ± 1265.6	444.2 ± 325.1	<0.001	1588.3 ± 1357.4
30-CST (Repetitions)	34.0 ± 5.2	31.5 ± 5.5	0.040	33.0 ± 5.4

30 Second STS Age Related Norms Chart

Male

Age	Below Avg	Average	Above Avg
60-64	<14	14-19	>19
65-69	<12	12-18	>18
70-74	<12	12-17	>17
75-79	<11	11-17	>17
80-84	<10	10-15	>15
85-89	<8	8-14	>14
90-94	<7	7-12	>12

Female

Age	Below Avg	Average	Above Avg
60-64	<12	12-17	>17
65-69	<11	11-16	>16
70-74	<10	10-15	>15
75-79	<10	10-15	>15
80-84	<9	9-14	>14
85-89	<8	8-13	>13
90-94	<4	4-11	>11

Other Potential Assessments:

Hand Held Dynamometer

New Wearable Tech:

- Smart watches
- HRV monitors
- Bands/rings



Photos:

Lentini, Zach, and Madison Franek. "Appendix C. Knee Joint Handheld Dynamometry Assessment Suggestions." *Journal of Orthopedic and Sport Physical Therapy*, 26 Oct. 2022.
"Heart Rate Variability and Orthostatic Test: Let's Talk Polar." *Polar Blog*, 7 Sept. 2023, www.polar.com/blog/heart-rate-variability-and-orthostatic-test-lets-talk-polar/?srsltid=AfmBOoy044OWcS55Sxndn8r6ZWhPVmJQ6dSL9EiWZHq5ezNCGUN_q.
Warwick, Stephen. "The Best Wearable and Fitness Tech of CES 2025: From the Garmin Instinct 3 to a New Oura Ring Rival." *TechRadar*, 7 Jan. 2025, www.techradar.com/health-fitness/the-best-wearable-and-fitness-tech-of-ces-2025.

Brief Intervention

Advice/Written Exercise Prescription:
FITT Principle

FREQUENCY



INTENSITY



TIME



TYPE



“Training recipe”

SAID principle:

Specific

Adaptations _(To)

Imposed

Demands

“You improve at what you consistently do”

Continued Support

Follow up

- Monitoring
- Accountability
- Progression of prescription

Support:

- Health team
- Technology
- Other healthcare/ Exercise professionals
- Support groups/community programs

My trust here is... 	Very high	Rather high	Rather low	High Low	n/a
Weekly newspaper	7%	15%	48%	22%	8%
Recommendation of a friend	23%	19%	50%	5%	3%
Recommendation of a relative	23%	35%	33%	5%	4%
Information on the internet	11%	11%	52%	23%	3%
Information of your health insurance provider	10%	40%	36%	10%	4%
Your GP	57%	33%	4%	4%	2%
Another medical specialist (e.g. orthopaedist)	22%	35%	22%	17%	4%

Questionnaire:

"How trustworthy do you find these sources of information on various exercise programs?"

Closing:

- **Exercise as Medicine**
 - ½ don't meet recommendations
 - 75-150 mins of activity/week
 - Especially important for CVD

- **ABC**
 - **A**ssessment
 - 6MWT, 30 sec sit-to-stand
 - **B**rief Intervention
 - FITT and SAID
 - **C**ontinued support

Additional Resources:

- <https://acsm.org/>
- <https://www.exerciseismedicine.org/>
- <https://www.aafp.org/pubs/afp/issues/2017/0401/p425.html>
- <https://www.ahajournals.org/doi/10.1161/circulationaha.104.502591>

Thank you!

References:

1. National Center for Health Statistics. Multiple Cause of Death 2018–2023 on CDC WONDER Database. Accessed February 1, 2025. <https://wonder.cdc.gov/mcd.html>
2. Stierman B, Afful J, Carroll MD, et al. National Health and Nutrition Examination Survey 2017–March 2020 prepandemic data files development of files and prevalence estimates for selected health outcomes. *Natl Health Stat Report*. 2021;158.
3. Elgaddal N, Kramarow EA, Reuben C. Physical activity among adults aged 18 and over: United States, 2020. NCHS Data Brief, no 443. Hyattsville, MD: National Center for Health Statistics. 2022. DOI: <https://dx.doi.org/10.15620/cdc:120213>
4. Mandsager K, Harb S, Cremer P, Phelan D, Nissen SE, Jaber W. Association of Cardiorespiratory Fitness With Long-term Mortality Among Adults Undergoing Exercise Treadmill Testing. *JAMA Netw Open*. 2018;1(6):e183605. doi:10.1001/jamanetworkopen.2018.3605
5. Tucker WJ, Fegers-Wustrow I, Halle M, Haykowsky MJ, Chung EH, Kovacic JC. Exercise for Primary and Secondary Prevention of Cardiovascular Disease: JACC Focus Seminar 1/4. *J Am Coll Cardiol*. 2022 Sep 13;80(11):1091-1106. doi: 10.1016/j.jacc.2022.07.004. PMID: 36075680.
6. Quindry JC, Michalak RE. Exercise-induced cardioprotection: From endogenous to exogenous mechanisms. *Sports Med Health Sci*. 2025 Mar 28;7(5):366-374. doi: 10.1016/j.smhs.2025.03.009. PMID: 40936660; PMCID: PMC12421174.
7. Lavie CJ, Milani RV, Marks P, de Gruiter H. Exercise and the heart: risks, benefits, and recommendations for providing exercise prescriptions. *Ochsner J*. 2001 Oct;3(4):207-13. PMID: 21765739; PMCID: PMC3116747.
8. Taylor JL, Holland DJ, Keating SE, Leveritt MD, Gomersall SR, Rowlands AV, Bailey TG, Coombes JS. Short-term and Long-term Feasibility, Safety, and Efficacy of High-Intensity Interval Training in Cardiac Rehabilitation: The FITR Heart Study Randomized Clinical Trial. *JAMA Cardiol*. 2020 Dec 1;5(12):1382-1389. doi: 10.1001/jamacardio.2020.3511. PMID: 32876655; PMCID: PMC7489382.
9. Wewege MA, Ahn D, Yu J, Liou K, Keech A. High-Intensity Interval Training for Patients With Cardiovascular Disease-Is It Safe? A Systematic Review. *J Am Heart Assoc*. 2018 Nov 6;7(21):e009305. doi: 10.1161/JAHA.118.009305. PMID: 30376749; PMCID: PMC6404189.
10. Gökaslan S, Yılmaz ÖF, Korucu C, Günlük NB, Balci A. Effects of soleus push-up exercise on systemic immune-inflammatory index and blood lipid profile in coronary artery disease. *Medicine (Baltimore)*. 2025 Aug 1;104(31):e43643. doi: 10.1097/MD.00000000000043643. PMID: 40760610; PMCID: PMC12323936.
11. Franklin BA, Eijssvogels TMH, Pandey A, Quindry J, Toth PP. Physical activity, cardiorespiratory fitness, and cardiovascular health: A clinical practice statement of the American Society for Preventive Cardiology Part II: Physical activity, cardiorespiratory fitness, minimum and goal intensities for exercise training, prescriptive methods, and special patient populations. *Am J Prev Cardiol*. 2022 Oct 13;12:100425. doi: 10.1016/j.ajpc.2022.100425. PMID: 36281325; PMCID: PMC9586849.
12. Bodker A, Visotcky A, Gutterman D, Widlansky ME, Kulinski J. The impact of standing desks on cardiometabolic and vascular health. *Vasc Med*. 2021 Aug;26(4):374-382. doi: 10.1177/1358863X211001934. Epub 2021 Apr 5. Erratum in: *Vasc Med*. 2023 Feb;28(1):NP1. doi: 10.1177/1358863X221142381. PMID: 33813968; PMCID: PMC9578685.
13. Lein DH Jr, Alotaibi M, Almutairi M, Singh H. Normative Reference Values and Validity for the 30-Second Chair-Stand Test in Healthy Young Adults. *Int J Sports Phys Ther*. 2022 Aug 1;17(5):907-914. doi: 10.26603/001c.36432. PMID: 35949374; PMCID: PMC9340829.
14. Lentini, Zach, and Madison Franeek. "Appendix C. Knee Joint Handheld Dynamometry Assessment Suggestions." *Journal of Orthopedic and Sport Physical Therapy*, 26 Oct. 2022.
15. Wangler, J., Jansky, M. The influence of GP advice on physical activity and health promotion in elderly patients – findings from a quantitative waiting room survey in Germany. *J Public Health (Berl.)* (2025). <https://doi.org/10.1007/s10389-025-02410-7>