EXERCISE AS A THERAPEUTIC INTERVENTION FOR THE CANCER SURVIVOR

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Case

- Jane Doe
  - 61 year old female
  - 12 months status post mastectomy (right breast)
  - TX: Surgery chemotherapy and radiation
  - Very active prior to surgery and adjuvant therapy
  - PT goals:
    - Reconditioning
    - Increased muscle strength
    - Return to pre-treatment level of activity

Objectives

- 1. Understand the basic response of the cancer survivor to the stress of exercise.
- 2. Be able to discuss the basics of exercise testing a cancer survivor
- 3. Be able to write an exercise prescription for a cancer survivor.

EXERCISE 101

Functional Implications of a Reduced VO_{2peak}

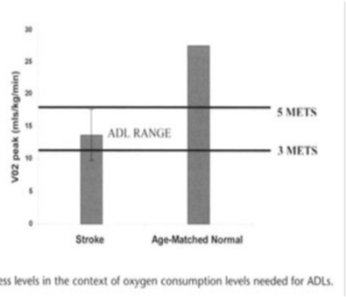


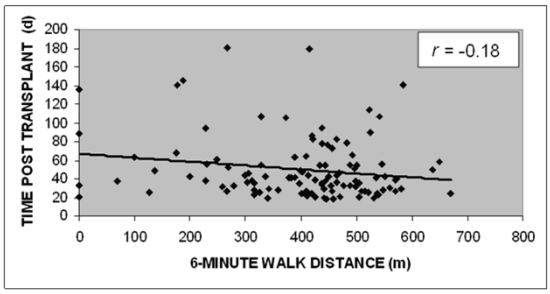
Figure 4. Peak fitness levels in the context of oxygen consumption levels needed for ADLs.

Ivey et al. *Topics in Stroke Rehabilitation*. Wntr 2005 v12 i1 p1(16).

Benefits of Exercise Training in the Cancer Survivor Population

IMPROVEMENTS IN	REDUCTIONS IN
• **Muscle mass, strength, power, endurance** • Physical function • Physical activity levels • Range of motion • Immune function • Chemotherapy completion rates • Body image, self esteem and mood	• Number of symptoms and side effects of Tx. • Duration of hospitalization • **Psychological and emotional stress** • **Depression and anxiety**

Exercise Behavior of Cancer Survivors



Scatter plot showing the relationship between individual 6-MWT distance and time post transplant.

Morris et al. BMT. 2009; 45:755-761

Exercise Behavior of Cancer Survivors Across the Continuum

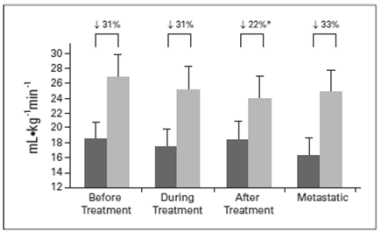
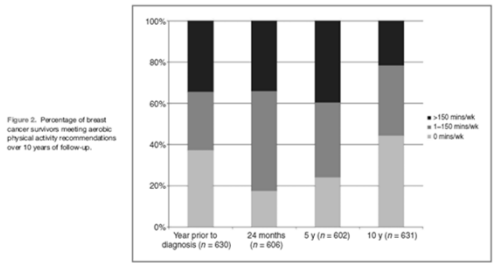


Fig 1. Differences in peak oxygen consumption (mL · kg^{-1}min^{-1}; gray bars represent age-sex predicted value) in operable patients with breast cancer before (n = 20), during (n = 46), and after (n = 130) adjuvant therapy, and with metastatic disease (n = 52). Statistical tests: (*) Significantly different from during adjuvant therapy and metastatic disease groups.

Jones, LW et al. JCO. 2012:30: 2530

Exercise Behavior of Breast Cancer Survivors

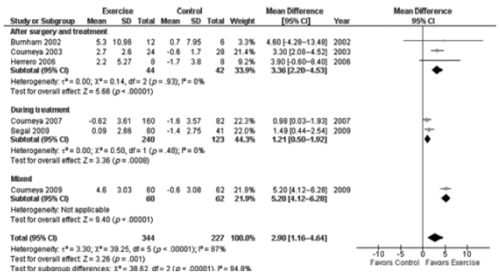


Mason et al. Cancer Epidemiol Bomarkers Prev. 2013; 22:1153

Is Exercise Safe for the Cancer Survivor?

- No reports of morbidity or mortality during maximal exercise testing of cancer survivor:
  - Scheetz J et al, APTA CSM, Nashville, TN, Feb., 2008
  - Jones LW et al, Lung Cancer 2007;55:225
  - Schmitz et al. Cancer Epidemiol Biomarkers Prev 2005;14:1672-80

Can the Cancer Survivor Adapt to Exercise Training?



Jones et al. The Oncologist. 2011;16:112

Can the Cancer Survivor Adapt to Exercise Training?

Table 4
Changes in Weight, BMI, and Physical Performance Before and After Exercise

	All ($n = 34$)		
	Mean (SD)		
	Pre	Post	*P* Value
Weight (kg)	74 (11.5)	73.6 (12.4)	0.10
BMI	25.2 (3.4)	25 (3.1)	0.08
Heart rate (beats/minutes)	119 (26)	122 (28)	0.24
6 minute walk (m)	481 (144)	510 (156)	0.007
"Sit to stand" (seconds)	5.1 (2.3)	4.1 (1.4)	0.001
Functional reach (cm)	30.4 (6.9)	32.8 (8.3)	0.07

Oldervoll et al. J Pain Symptom Management. 2006;31:421.

Can the Cancer Survivor Adapt to Exercise Training?

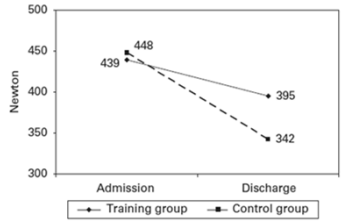


Figure 1 Development of strength (mean value in Newton) in the training group and the control group compared at the time of admission and at the time of discharge

Baumann et al. Bone Marrow Transplant. 2010;45:355.

Exercise and Cancer Prevention

- "Evidence suggests that 1/3d of the more than 500,000 cancer deaths that occur in the US can be attributed to diet and physical activity habits…"
  - Kushi et al. CA Cancer J Clin. 2006
- American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention.
  - CA Cancer J Clin 2006;56;254-281

Exercise Training Along the Cancer Continuum

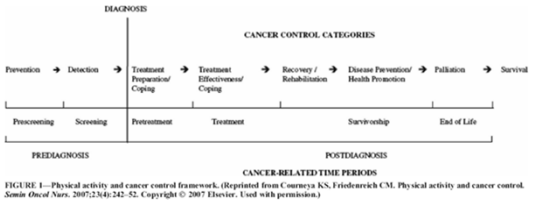


FIGURE 1—Physical activity and cancer control framework. (Reprinted from Courneya KS, Friedenreich CM. Physical activity and cancer control. *Semin Oncol Nurs.* 2007;23(4):242–52. Copyright © 2007 Elsevier. Used with permission.)

Physical Activity and Cancer Control Framework (PACC)
"Windows of Opportunity" for exercise based therapeutic interventions

Summary

1. Cancer survivors tend not to exercise after the diagnosis or after completing treatment.
2. Cancer survivors can safely participate in exercise training at all points along the cancer trajectory.
3. Cancer survivors can adapt to exercise training at all points along the cancer continuum.
4. Exercise training can bring about **positive physiological and psychological changes** in cancer survivors

Making it safe for a cancer survivor to participate in a therapeutic exercise program?

Exercise Guidelines

- 2008 Physical Activity Guidelines for Americans
- American College of Sports Medicine Roundtable on Exercise Guidelines for Cancer Survivors
- ACSM's Guidelines for Exercise Testing and Prescription

Acute CV Response To Exercise

⇑ HR, SP

⇑ CO

⇑ SV

⇑ RR

⇑ MVO_2

↓↑ O_2 sat., DP

Exercise Guidelines

- 2008 Physical Activity Guidelines for Americans
- American College of Sports Medicine Roundtable on Exercise Guidelines for Cancer Survivors
- ACSM's Guidelines for Exercise Testing and Prescription

Absolute Contraindications to Participating in Exercise

- Recent significant change in resting ECG
- Unstable angina
- Uncontrolled cardiac dysrhythmias causing symptoms or hemodynamic compromise
- Uncontrolled HF
- Acute PE or pulmonary infarction
- Acute systemic infection, accompanied by fever, body aches, or swollen lymph

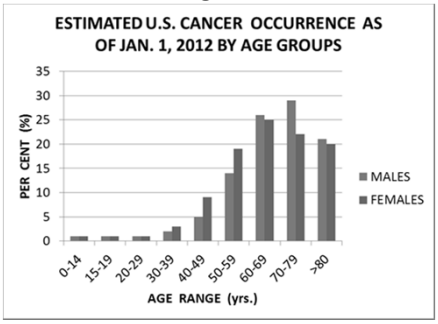
ACSM Guidelines for Exercise Testing and Prescription, 9th edition. 2014

Relative Contraindications to Participating in Exercise

- Electrolyte abnormalities (K^+ < 3.5 mmol/liter)
- Severe arterial hypertension (at rest)
  - Systolic BP > 200 mmHg
  - Diastolic BP> 110 mmHg
- Uncontrolled metabolic disease

ACSM Guidelines for Exercise Testing and Prescription, 9th edition. 2014

Cancer Diagnosis as a Function of Patient Age



American Cancer Society, Cancer Treatment & Survivorship. 2012-2013 Society, Cancer Treatment & Survivorship. 2012-2013

Cancer History and Comorbidities

- 301 lung, breast, prostate and colon cancer patients
  - 80% had co-existent disease
  - 70% had cardiopulmonary disease
  - 24-48% HTN
  - 8-24% CAD
  - 8-18% DM
  - 4-12% COPD
  - 34-57% Arthritis
  - These data "demonstrates that the burden of coexistent diseases is considerable"

– Ko & Chaudhry, J Surg Res. 2002

Survivor Interview/ History Cancer? YES; TXT: Radiation

- Radiation? **YES**
  - Start/ End Dates?
  - Dosage?
  - Field?
  - Response?
  - Residual symptoms?

History of XRT: Why Ask?

- Adjust **evaluation**
  - Screen for anticipated deficits within the radiation field
- Adjust **intervention**
  - **Treat deficits located within the radiation field:**
- Impact on anticipated rehab **outcomes**
  - Example: musculoskeletal disorders

Survivor Interview/History Cancer? YES; TXT- Surgery

Old

- What type?
- Surgery? **YES**

New

- Site and **Stage**?
- Surgery? **YES**
  - When?
  - What procedure?
  - Post-op course?
  - Residual symptoms?

History of Surgery: Why Ask?

- Adjust **evaluation**
  - Screen for anticipated deficits in the surgical field or linked to it
- Adjust **intervention**
  - **Site of interest: Cervical s/p H&N cancer**
- Impact on anticipated rehab **outcomes**
  - Example: musculoskeletal disorders

Survivor Interview/ History Cancer? YES; TXT: CHEMOTHERAP

- Chemotherapy? **YES**
  - Start/ End Dates?
  - Dosage? **Dose Reduction?**
  - Drug names?
  - Response/ Residual symptoms?

History of Chemo: Why Ask?

- Adjust **evaluation**
  - Screen for anticipated deficits created by the chemotherapeutic agent
- Adjust **intervention**
  - **Manage deficits in areas impacted by the chemotherapy**
- Impact on anticipated rehab **outcomes**
  - Example: musculoskeletal disorders

Safety Considerations

Exercising Safely: CV Considerations

Common sense is your best guide in answering these few questions. Please read them carefully and check the (X) YES or NO opposite the question if it applies to you.

YES	NO	
( )	( )	1. Has your doctor ever said you have heart trouble?
( )	( )	2. Do you frequently have pains in your heart and chest?
( )	( )	3. Do you often feel faint or have spells of severe dizziness?
( )	( )	4. Has a doctor ever said your blood pressure was too high?
( )	( )	5. Has your doctor ever told you that you have a bone or joint problem such as arthritis that has been aggravated by exercise, or might be made worse with exercise?
( )	( )	6. Is there a good physical reason not mentioned here why you should not follow an activity program even if you wanted to?
( )	( )	7. Are you age 65 or over and not accustomed to vigorous exercise?

YES TO ONE OR MORE QUESTIONS

If you have not recently done so, consult with your personal physician by telephone or in person **BEFORE** increasing your physical activity and/or taking a fitness test. Tell him/her what questions you answered **YES** on **PAR-Q**, or show him/her your copy.

Physical Activity Readiness Questionnaire (PAR-Q). ACSM Guidelines for Exercise Testing and Prescription, 9th edition. 2014

Chemo Induced Peripheral Neuropathy (CIPN)

- A set of symptoms or problems caused by damage to peripheral nerves
- In most cases is a sensory deficit, but can also include motor deficits and autonomic deficits
- Often but not always, diminishes after chemotherapy stopped

Problems Associated with CIPN

- Dizziness
- Balance impairments
- Decreased muscle strength
- Increased falls risk
- Loss of skin sensation
  - Inspect hands and feet daily
- Cold Induced skin sensitivity
  - Eat and drink foods and beverages at room temperature

CIPN: Assessment

- Modified Total Neuropathy Score
  - Assess sensory symptoms (paresthesias, numbness, neuropathic pain, myalgias)
  - Assess motor symptoms (hand dexterity, gait, muscle strength)
  - DTR's (UE and LE)
  - Biothesiometer
    - (measures simply and accurately the threshold of appreciation of vibration in human subjects)
      - Wampler et al. Supportive Onc. 2006

Functional Assessment of Chronic Illness Therapy Questionnaire- FACIT

- A collection of QOL questionnaires targeted to the management of chronic illness.
- The FACT-G (now in Version 4) is a 27-item compilation of general questions divided into **four primary QOL domains: Physical Well-Being, Social/Family Well-Being, Emotional Well-Being, and Functional Well-Being.**
- Disease questionnaires, symptom questionnaires
- **Facit.org**

Fall Risk

- Breast cancer survivors (age <70 years) s/p chemotherapy, + or - hormone therapy
  - 75% had >1 fall over 18 months, vs. 45% in the controls
- Prostate cancer survivors (age >70 years) receiving androgen deprivation therapy
  - 22% had >1 fall over 3 months, vs. 6% to 9% in general elderly populations
- 1 in 2 patients with advanced cancer falls fell during the 6-month follow-up, regardless of age

- Bylow 2008, Winters-Stone 2009, Stone 2011

Why is There an Increased Fall Risk?

- Age
- CIPN
- Pain
- Depression
- Incontinence
- Impaired cognition
- **Vestibular dysfunction**
- **Impaired vision**
- Use of assistive devices
- Impaired physical performance
- Environmental issues
- **screen for fall risk in all settings**

Assess Balance

- Standing Balance
  - Clinical Test Sensory Interaction and Balance (CTSIB) (Shumway-Cook, A. 1986)
  - Single Leg Stance
    - <5 sec (Vellas, BJ., 1997)
  - Tandem stance
    - < 10 sec (Rossiter-Fornoff, JE., 1995) or Need for assist into position (Hile E., 2012)
  - With head movements, dual-task
  - 5 X S-T-S: > 12 sec (Tiedemann, A. 2008)

Falls Risk Assessment

- STEADI (Stopping Elderly Accidents, Deaths & Injuries) Tool Kit for Health Care Providers
  - The STEADI Tool Kit gives health care providers the information and tools they need to assess and address their older patients' fall risk.
- http://www.cdc.gov/homeandrecreationalsafety/Falls/steadi/index.html?s_cid=tw_injdir154

Osteoporosis and Cancer

- Association with cancer treatments
  - Surgical oophorectomy,
  - Chemotherapy-induced ovarian failure
    - Cyclophosphomides, platinum agents, anthracyclines, taxanes
  - Androgen deprivation therapy
  - Aromatase inhibitors
  - **Glucocorticoid therapy**
  - **Bone irradiation**

Osteoporosis Screening Tool

- Osteoporosis prescreening risk assessment or (OPERA)
  - **selection cut point: score ≥ 2 points**
  - Age ‡65 years 1 pt.
  - Weight <57 kg (125.4 lb.) 1 pt.
  - History of minimal trauma fracture after age 45 1 pt.
  - Early menopause (before the age of 45 years) 1 pt.
  - Steroid use >6 months (>5 mg/day) 1 pt.
    - Salaffi et al. Clin Rheumatol. 2005;24:203–211

http://www.shef.ac.uk/FRAX/

Screen for Pain

- Use accepted assessment tools and screen all survivors
  - Likert Scale
  - Brief Pain Inventory
    - (Cleeland C. 1994;23:129)
- Ask about ALL pain
  - Consider cancer treatments
- Refer immediately for concerning pain
  - > 6-7 on Likert scale or BFI
  - In light of continued survivorship care

"Chemobrain"

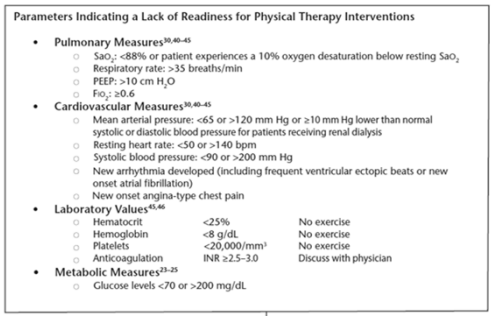
- Chemo Brain"/ Anecdotal
- Higher order mental functioning affected, executive function
- May happen, may not happen, may be transient
- What is a clinically significant decline, a statistically significant decline
- May be dependent on subject age

Exercising Safely: Lab Values & Signs

Hemoglobin < 8.0 g/dL	Avoid high-intensity activities (oxygen transport)
Absolute neutrophil count $\leq$ 0.5 X 10^9/µL	Avoid activities that may increase risk of bacterial infection
Platelet count < 50 X 10^9/L	Avoid activities that increase risk of bleeding
Fever >38°C (100.4°F)	Systemic infection / why?/ neutropenic contraindicated
Ataxia, dizziness, peripheral sensory neuropathy	Avoid activities that require significant balance and coordination

Courneya, KS. Physician and Sportsmed. 30: 33.2002

Exercising Safely: Lab Values & Signs Exercise Precautions



Parameters Indicating a Lack of Readiness for Physical Therapy Interventions

- **Pulmonary Measures**[30,40–45]
  - SaO_2: <88% or patient experiences a 10% oxygen desaturation below resting SaO_2
  - Respiratory rate: >35 breaths/min
  - PEEP: >10 cm H_2O
  - Fio_2: ≥0.6
- **Cardiovascular Measures**[30,40–45]
  - Mean arterial pressure: <65 or >120 mm Hg or ≥10 mm Hg lower than normal systolic or diastolic blood pressure for patients receiving renal dialysis
  - Resting heart rate: <50 or >140 bpm
  - Systolic blood pressure: <90 or >200 mm Hg
  - New arrhythmia developed (including frequent ventricular ectopic beats or new onset atrial fibrillation)
  - New onset angina-type chest pain
- **Laboratory Values**[45,46]

Hematocrit	<25%	No exercise
Hemoglobin	<8 g/dL	No exercise
Platelets	<20,000/mm³	No exercise
Anticoagulation	INR ≥2.5–3.0	Discuss with physician

- **Metabolic Measures**[23–25]
  - Glucose levels <70 or >200 mg/dL

Nordib-Craft et al. PTJ. 2012;92:1494

Cancer Related Fatigue

- "a distressing, persistent, subjective sense of tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning."
  - National Comprehensive Cancer Network (NCCN) NCCN
- CRF is experienced by 70%-100% of cancer patients while receiving chemotherapy
- CRF may continue to be disruptive even months and years after treatment ends

EXERCISE & CRF

Conclusion:

- "Exercise can be regarded as beneficial for individuals with cancer-related fatigue during and post cancer therapy. Further research is required to determine the optimal type, intensity and timing of an exercise intervention."

-Cramp & Daniel J. *Cochrane Database of Systematic Reviews* 2008, Issue 2. Art. No.: CD006145. DOI: 10.1002/14651858.CD006145.pub2

Assessment of CRF: Screening

Assessment of CRF

- BFI- Brief Fatigue Inventory
  - Tito R et al. Cancer 1999;85;1186.
- FACT-Fatigue: The Functional Assessment of Cancer Therapy-Fatigue
- Piper Fatigue Self-Report Scale
- MFSI-Multidimensional Fatigue Symptom Inventory
- The Schwartz Cancer Fatigue Scale

Oncology patients are complex

- Disease
  - Impairments can be related to primary or metastatic disease
- Surgery
  - Acute impairments
- Radiation
  - Acute impairments
  - Late or persistent impairments
- Chemotherapy
  - General impairments
  - Drug specific impairments

With permission-M. Wampler-Kuhn, PT, DPTSc

EXERCISE TESTING

What is Exercise Testing?

- A noninvasive procedure that evaluates an individual's capacity for dynamic exercise.
- Outcomes provide:
  - Diagnostic information
  - Prognostic information
  - Define exercise/functional capacity
  - Provide baseline and follow-up data
  - Provide guidance in directing exercise training program

Exercise Testing and Current Guidelines

- "No exercise testing required before walking, flexibility, or resistance training. Follow ACSM guidelines for exercise testing **before moderate to vigorous** aerobic exercise training."
  - Schmitz KH, et al. Med Sci Sports Exerc. 2010;42: 1409.
- Moderate intensity: 40-60% of heart rate reserve (HRR)
- Vigorous intensity: 60- 90% of HRR

Exercise Testing and Current Guidelines

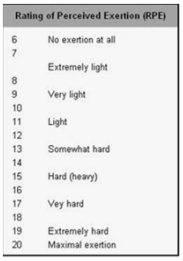
- Exercise testing vs. Functional Assessment
  - Aerobic capacity and ability to carry out ADLs
  - Aerobic capacity and ability to ambulate
  - Outcome measures (6 min. walk test, The Functional Status Index)
- May simply be a difference in profession specific terminology

Cardiopulmonary Exercise Testing (CPET)

Exercise Testing: Submaximal

- **Submaximal Exercise Test:**
  - Patient achieves a predetermined **submaximal** exertional level and then test is stopped
  - May be symptom limited or have a predetermined end point (85% HR_{max})
  - Is a ramped, progressive protocol
  - No expired gas analysis performed
  - VO_{2max} can be **extrapolated** from the results of this test

Functional Exercise Testing Physiological Monitoring



Rating of Perceived Exertion (RPE)	
6	No exertion at all
7	
	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard (heavy)
16	
17	Vey hard
18	
19	Extremely hard
20	Maximal exertion

Borg, GA. Med Sci Sports Exer. 1982;14:377)

Exercise Testing Protocol: Bruce Protocol (Treadmill)

Stage	*Speed (mph)*	*Gradient (%)*	Time
1	**1.7**	**10**	**3**
2	**2.5**	**12**	**6**
3	**3.4**	**14**	**9**
4	**4.2**	**16**	**12**
5	**5**	**18**	**15**
6	**5.5**	**20**	**18**
7	**6**	**22**	**21**
8	**6.5**	**24**	**24**
9	**7**	**26**	**27**
10	**7.5**	**28**	**30**

Modified Bruce Protocol

STAGE	SPEED (MPH)	INCLINE (%)
1	1.7	0
2	1.7	5
3	1.7	10
4	2.5	12
5	3.4	14
6	4.2	16
7	5	18

Exercise Testing: Bruce Protocol (Treadmill)

- What information can we derive from this test if expired gases are not analyzed?
  - Stage completed
  - Exercise duration (min & sec)
  - HR/RPE/Dyspnea at fixed work loads i.e. at the end of a given stage
    - Each stage = a fixed work load

Exercise Testing: Bruce Protocol (Treadmill)

- We can **estimate** peak VO_2:
  - Women active or sedentary: VO_{2peak} (ml/kg/min) = 4.38 X Time (min & fraction) – 3.90
  - Men active or sedentary: VO2max (ml/kg/min) = 2.94 X time (min & fraction) + 7.65

Exercise Testing: Bruce Protocol (Treadmill)

- Estimated peak VO_2 (70 YOA male)
  - Ran for 3 min 39 sec or 3.65 min or into stage 1
  - VO_{2max} (ml/kg/min) = 2.94 X time (min & fraction) + 7.65
  - VO_{2max} (ml/kg/min) = 2.94 X 3.65 + 7.65
  - VO_{2max} (ml/kg/min) = 18.38
  - Functional status ??
  - Physiological status ??

Functional Implications of a Reduced VO_{2peak}

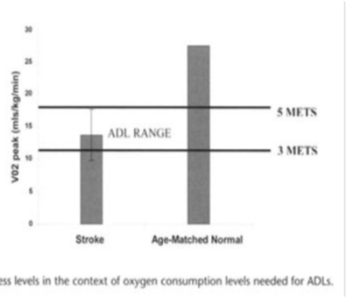


Figure 4. Peak fitness levels in the context of oxygen consumption levels needed for ADLs.

Ivey et al. *Topics in Stroke Rehabilitation*. Wntr 2005 v12 i1 p1(16).

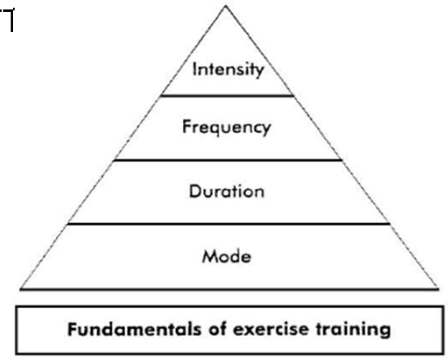
Ascribing Fitness Levels using Aerobic Capacity: (Females; ml/kg/min)

Age	Very Poor	Poor	Fair	Good	Excellent	Superior
13-19	<25.0	25.0 - 30.9	31.0 - 34.9	35.0 - 38.9	39.0 - 41.9	>41.9
20-29	<23.6	23.6 - 28.9	29.0 - 32.9	33.0 - 36.9	37.0 - 41.0	>41.0
30-39	<22.8	22.8 - 26.9	27.0 - 31.4	31.5 - 35.6	35.7 - 40.0	>40.0
40-49	<21.0	21.0 - 24.4	24.5 - 28.9	29.0 - 32.8	32.9 - 36.9	>36.9
50-59	<20.2	20.2 - 22.7	22.8 - 26.9	27.0 - 31.4	31.5 - 35.7	>35.7
60+	<17.5	17.5 - 20.1	20.2 - 24.4	24.5 - 30.2	30.3 - 31.4	>31.4

Ascribing Fitness Levels using Aerobic Capacity: (Males; ml/kg/min)

Age	Very Poor	Poor	Fair	Good	Excellent	Superior
13-19	<25.0	25.0 - 30.9	31.0 - 34.9	35.0 - 38.9	39.0 - 41.9	>41.9
20-29	<23.6	23.6 - 28.9	29.0 - 32.9	33.0 - 36.9	37.0 - 41.0	>41.0
30-39	<22.8	22.8 - 26.9	27.0 - 31.4	31.5 - 35.6	35.7 - 40.0	>40.0
40-49	<21.0	21.0 - 24.4	24.5 - 28.9	29.0 - 32.8	32.9 - 36.9	>36.9
50-59	<20.2	20.2 - 22.7	22.8 - 26.9	27.0 - 31.4	31.5 - 35.7	>35.7
60+	<17.5	17.5 - 20.1	20.2 - 24.4	24.5 - 30.2	30.3 - 31.4	>31.4

FITT



FITT Principle

- FITT Principal: **frequency, intensity, time (duration), type (mode)**
- **Threshold model**
  - Achieve **sufficient** physiological challenge to bring about adaptive changes/training effects, reconditioning

FITT Principle: **Frequency**

- The number of days per week dedicated to an exercise program
- 3-5 days/wk. of moderately intense activity
- 3 days/ wk. of vigorously intense activity
- 3-5 days/wk. if moderately and vigorously intense activity are combined
- Adequate recovery time

Exercise Prescription: **F**ITT

- Frequency (mitigating factors):
  - Aerobic exercise: 3 sessions per week
  - Initial fitness level
  - Medical treatment may reduce this frequency
  - Occurrence of setbacks or complications
  - More than once X per day for short period of time if patient is very deconditioned
  - 3d party payer

FITT Principle: **Intensity**

- How hard one is working
- Exercise Intensity:
  - % of $VO2_{max}$
  - % of estimated $VO2_{max}$
  - % of estimated heart rate maximum
  - **% of estimated heart rate reserve**
  - % of 6-min walk distance
    - (6 min walk dist. (m)/100)
  - **RPE: 12-14 or 5-6**
  - % 1-RM

FITT Principle: Intensity
Estimating Age Specific HR_{max}

- Estimating heart $rate_{max}$:
  - **HR_{max} = 220 – age**
    - Traditional method
  - **HR_{max} = 207 - (0.7 X age)**
    - Tanaka et al. J Am Col Cardiol. 2001; 37:153.
  - **HR_{max}= 205.8 – (0.685 X age)**
    - Inbar et al. Med Sci Sport Exerc 1994;26:538-546

FITT Principle: Intensity
Estimating Age Specific HR_{max}

- HR_{max} = 220 - age
  HR_{max} = 220 - 70 YOA
  = 150 BPM
- HRmax = 207 - (0.7 X age)
  HR_{max} = 207 – (0.7 X 70)
  = 158 BPM
- 65% of HR_{max}
  = 0.65 X 150 BPM = 98 BPM
  = 0.65 X 158 BPM = 103 BPM

FITT Principle: **Intensity**
Estimating Heart Rate Reserve (HRR)

- Heart rate reserve (HRR) provides the best available approximation of a specific VO_{2max}.
- Determining HRR of a 70 YO
  - Actual available range/reserve in HR
  - **HRR = (Estimated HRmax - HRrest)**
  - HHR = (158 BPM – 72 BPM)
    = 86 BPM

FITT Principle: **Intensity**
Exercise intensity as a function of HRR

- **Express intensity as a fraction (%) of the HRR**
- 65% of HRR; 70 YOA, HR_{rest} = 72 BPM
  - Target Heart Rate = $HR_{resting}$ + [0.65 X HRR]
- THR = 72 BPM + [0.65 X (86 BPM)]
  - THR = 72 BPM + [56 BPM]
  - **THR = 128 BPM**
- THR range: 55-65%. Calculate the actual THR range

FITT Principle: **Intensity**

- Factors defining exercise intensity:
  - Age, program goals, exercise capabilities, health status and fitness levels
  - Less fit initially, history of being sedentary - Start at light intensity, even at the low end of light intensity
  - Obese survivors should at low end of light intensity to minimize risk of musculoskeletal injury

FITT Principle: **Intensity**

- Defining exercise intensity:
  - **Light intensity: 30% - < 40% HRR or RPE = 1-3 (scale of 1-10)** or **normal or slight breathing**
  - **Moderate intensity: 40 - <60% HRR or RPE = 4-5 (scale of 1-10)** or **elevated breathing**
  - **High intensity: 60% - < 90% HRR or RPE = 5-7 (scale of 1-10)** or **heavy breathing**

Exercise Prescription: F**I**TT

FITT Principle: **Type** (Mode))

- Exercise Type (Mode):
  - What is available?
  - **What does the patient want to do?**
  - What is safe for the patient?
  - Aerobic **and** (not or) strength training

FI**T**T Principle: **Type** (Mode)

- **Type or Mode**
  - Should involve large muscle groups
  - Disease or treatment may require that specific muscles be exercised
  - Walking, cycling, wall swimming (risk for infection?)
  - Patient must enjoy the selected activity

FITT Principle: **Time** (Duration)

- **Exercise Duration**
  - Total amount of time spent exercising
    - Per session or per week
  - **Shorter exercise periods, greater frequency**
    - 3 X 10 min/session vs. 1 30 min session
    - Use for less fit individual
  - **Long Term Goal**: 30 min of continuous activity and 150 min/wk. of moderate activity
  - 1 X 30 min/session

FIT**T** Principle: **Time** (duration)

- **Progress duration first in carrying out an exercise prescription**
- Recommended exercise time can be performed continuously or intermittently and can be accumulated over the course of the day
- A single exercise session should generally last at least 10 min.
- Exercise bouts of < 10 min may be effective but more data are needed
  - Garber et al. Med Sci Sports Exer. 2009;41:459

FITT Principle: **Volume**

- How much exercise time is actually spent in the target heart rate range?
- Monitor and record HR during exercise session
  - Documents time spent in the THR zone
  - Demonstrates a sufficient physiological challenge
- Periodically record exercise time and HR

Exercise Prescription - **Progression**

- Can increase any component of the exercise model i.e. FITT
- **Initially consider increasing duration**
  - Increase session length by 5-10 min/session per week
- **Next progress frequency**
- **Finally progress intensity**
- **Progression should be gradual and anticipate setbacks**
- **Triangulate exercise intensity with RPE information**

Exercise Prescription - **Progression**

- Rate of progression depends on the following:
  - Individual's health status
  - Changes in Individual's health status
  - Physical fitness status
  - Training response
  - Exercise program goals
- Increasing duration 5-10 min is reasonable for the average adult every 1-2 wks. over the first 4-6 wks.
- Any progression should be made gradually to minimize the risk of musculoskeletal injury, muscle soreness, undue fatigue and overtraining

Exercise Prescription - **Progression**

- Overall goal for cancer survivors should be to meet exercise guidelines established for healthy individuals (150 min of moderate activity/wk.)
- When older adults cannot do 150 minutes of moderate-intensity aerobic activity a week because of chronic conditions, they should be as physically active as their abilities and conditions allow

Exercise Prescription - Example

Table 2: Aerobic Training Alone Program

		Supervised Aerobic Training		
Training Phase	**Week**	**Weekly Sessions**	**Duration (min/ session)**	**Intensity (% of VO_{2peak})**
Introductory	0-4	2-3	15-25	50-60
Intermediate	5-8	3	20-30	60-70
Maintenance	9-16	3	25-45	≥70

*Weeks intervals shown are goals and may vary for individual patients; All exercise sessions must be performed in a supervised setting.

Jones et al. BMC Cancer 2010, 10:155

Exercise Prescription

- Patient:
- 51 YOA female; Breast cancer survivor, s/p mastectomy
- Adjuvant Tx.: Chemo; XRT
  - Completed Tx. Some 10 yrs. before
- CV and fitness assessment:
  - Time completed: 6.17 min., into 3^{d} stage
  - Estimated VO_2max: 22.87 ml/kg/min
  - Fitness level: Poor-fair

Exercise Prescription FI**T**T- Example

- Medical/Physical concerns:
  - Surgical scarring-right breast area & under right arm
  - Knee pain
- Exercise Rehabilitation Recommendations:
  - **Type/Mode**: Treadmill/stationary bike
    - At home continue walking program
    - If fatigued, use the bike

Exercise Prescription
FI**TT-** Example

- Exercise Rehabilitation Recommendations:
  - **Frequency**:
    - Exercise at least **3 times per week**
    - Supervised exercise 2 times per week
    - Walk on your own 1-2 times per week
  - **Duration:**
    - Start at 10-15 min per exercise session
    - Progress to 30 min per exercise session
      - 5-7 min. every 2 weeks
    - Can mix & match bike & treadmill

Exercise Prescription
F**I**TT-Example

- CV fitness level: Low-fair; completed 2 stages of the Bruce test
- THR range: 40-60% of HRR
  - 122-138 BPM
  - Start closer to 122 BPM
  - RPE: 2-5; again start low and progress
  - If fatigued, decrease intensity to 2-3
  - This would be reflected in HR

Exercise Prescription
FITT-**P -** Example

- Progression:
  - Increase duration when?
    - Beginning of each week
  - Base progression on physical activity status of the preceding visit and adherence to HEP
  - Determine fatigue after progressing duration
  - Corrections can be made at any time in the program
  - Avoid excessive fatigue
  - Document progression changes

Exercise Session Schedule

- Warm up
- Activities
- Cool Down
- Flexibility activities

Exercise Prescription: Strengthening/Resistance Training

- An **important part of exercise rehabilitation** for the cancer patient
- Recommendations:
  - ROM, elastic bands then progress to weight equipment (machines).
  - Exercise large muscle groups
  - Proper form must be taught
  - Start conservatively

Schneider, CM. Exercise & Cancer Recovery. 2003. Human Kinetics. Champaign, IL.

Exercise Prescription: Strengthening/Resistance Training

- General Considerations:
  - Resistance training should be encouraged
  - **Initially 1 set of 8-15 reps**
  - **Incorporate 8-10 different dynamic exercises into the prescription**
  - **Increasing the number of reps** first then increase the number of sets
  - RPE of 4-6

Exercise Prescription: Strengthening/Resistance Training

- General Considerations:
  - Resistance exercises **performed on non-consecutive days**
  - Consider stair climbing or other activities that use the major muscle groups and **use body weight** as resistance exercises

Exercise Prescription: Strengthening/Resistance Training

- Establishing a base line for resistance training
  - No exercise testing required. Schmitz et al., 2010.
  - 1-RM
    - Exercise intensity expressed as a % of this 1-RM [lower %, higher # of reps]
    - Determining 1-RM is safe but problematic

Exercise Prescription: Strengthening/Resistance Training

- Establishing a base line for resistance training
  - 6-10 rep test
    - Subject moves a weight that fatigues him/her within 6-10 reps.
    - Use this weight as the baseline and as the basis for progression
    - First progress the number of reps, then the number of sets

Exercise Training Session

- Components of an exercise training session:
  - Warm-up: 5-10 min, (< 40%VO2 or HRR)
  - Stretching: 5-10 min
  - Conditioning: variable
  - Cool down: 5-10 min

Exercise Prescription: Other considerations

- The following Guidelines are just for older adults:
  - When older adults cannot do 150 minutes of moderate-intensity aerobic activity a week because of chronic conditions, they **should be as physically active as their abilities and conditions allow**.
  - Older adults should do exercises that **maintain or improve balance** if they are at risk of falling.

Exercise Prescription: Other Considerations

- Guidelines for older adults with chronic disease:
  - Older adults should determine their level of effort for physical activity relative to their level of fitness.
  - Older adults with chronic conditions should understand whether and how their conditions affect their ability to do regular physical activity safely.

DHHS. 2008 Physical Activity Guidelines for Americans

Exercise Prescription: Other Considerations

- Guidelines for older adults chronic disease:
  - This population should work **with their health-care providers** to adapt physical activity so that it is appropriate for their condition
  - **Strengthening and balance may need to precede aerobic training among frail elderly**.

DHHS. 2008 Physical Activity Guidelines for Americans

Exercise Prescription: Other Considerations

- Exercise intensity:
  - The heterogeneity of fitness levels in older adults, for some older adults a moderate-intensity walk is a slow walk, and for others it is a brisk walk.
  - **For this reason, use a 0-10 RPE scale to judge intensity rather than HR**
  - Make certain the client understands this scheme
- Should perform exercises **that maintain or improve** balance

Nelson, ME et al. Med Sci Sport and Exer. 2007;39:1435.

Summary

- Cancer survivors are often complex patients.
- As a group they are in need of strengthening and reconditioning.
- Training programs have been defined at a gross level but not on an individual level.
- Determining and managing fatigue and exercise intensity is critical.
- Successfully meeting training goals requires significant clinical decision making on the part of the physical therapist.

Thank you for the privilege of the podium