The effect of exercise recommendation on the level of physical activity in Breast cancer survivors

Prof. Justin Y. Jeon

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Exercise medicine center for diabetes and cancer patients

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Shinchon Severance Hospital,

University of Alberta Era (1995 – 2003)

Dr. Robert Steadward

Dr. Edmond Ryan

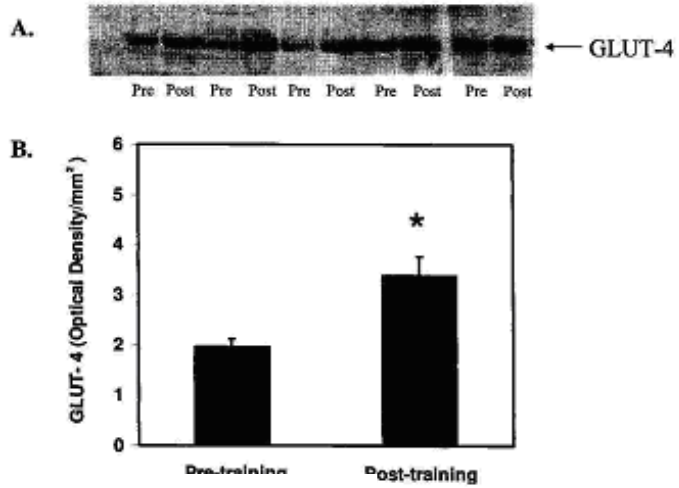
Original Article

Improved glucose tolerance and insulin sensitivity after electrical stimulation-assisted cycling in people with spinal cord injury

JY Jeon*[,1,2], CB Weiss[2], RD Steadward[1,2], E Ryan[3], RS Burnham[2,4], G Bell[2], P Chilibeck[5] and GD Wheeler[1,2]

Reduced Plasma Glucose and Leptin After 12 Weeks of Functional Electrical Stimulation–Rowing Exercise Training in Spinal Cord Injury Patients

Justin Y. Jeon, PhD, Dries Hettinga, PhD, Robert D. Steadward, PhD, Garry D. Wheeler, PhD, Gordon Bell, PhD, Vicki Harber, PhD



Intact Sympathetic Nervous System Is Required for Leptin Effects on Resting Metabolic Rate in People with Spinal Cord Injury

JUSTIN Y. JEON, ROBERT D. STEADWARD, GARRY D. WHEELER, GORDON BELL, LINDA McCARGAR, AND VICKI HARBER

Leptin response to short-term fasting in sympathectomized men: role of the SNS

The Journal of Clinical Endocrinology & Metabolism 88(1):402–407

JUSTIN Y. JEON,[1,2] VICKI J. HARBER,[2] AND ROBERT D. STEADWARD[1]
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Am J Physiol Endocrinol Metab 284: E634–E640, 2003.

Joslin Diabetes Center (2003-2004)

Terry Maratos-Flier
Jeffrey Flier

Beth Israel Deaconess Medical Center (2004-2005)

Mice with MCH ablation resist diet-induced obesity through strain-specific mechanisms

Efi Kokkotou,[1,3,4,*] Justin Y. Jeon,[1,2,4,*] Xiaomei Wang,[1] Francis E. Marino,[1,2]
Michael Carlson,[1] Daniel J. Trombly,[1] and Eleftheria Maratos-Flier[1,2,4]
[1]*Joslin Diabetes Center, Boston, Massachussetts;* [2]*Division of Endocrinology,* [3]*Division of Gastroenterology,*
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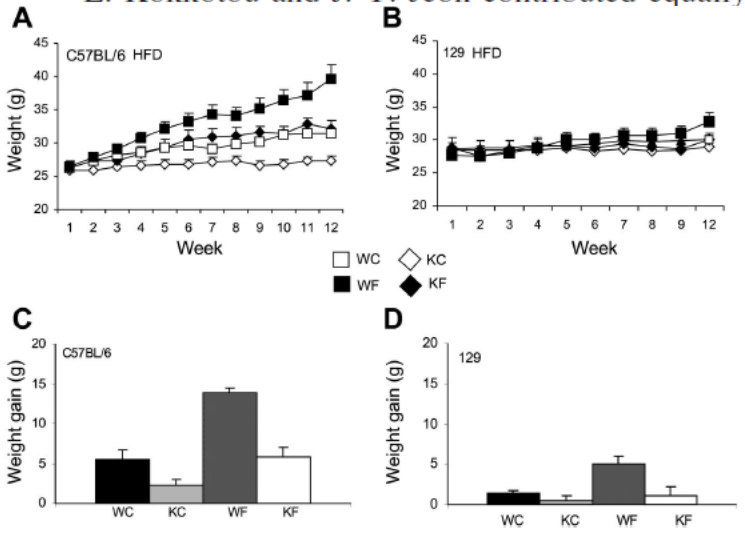
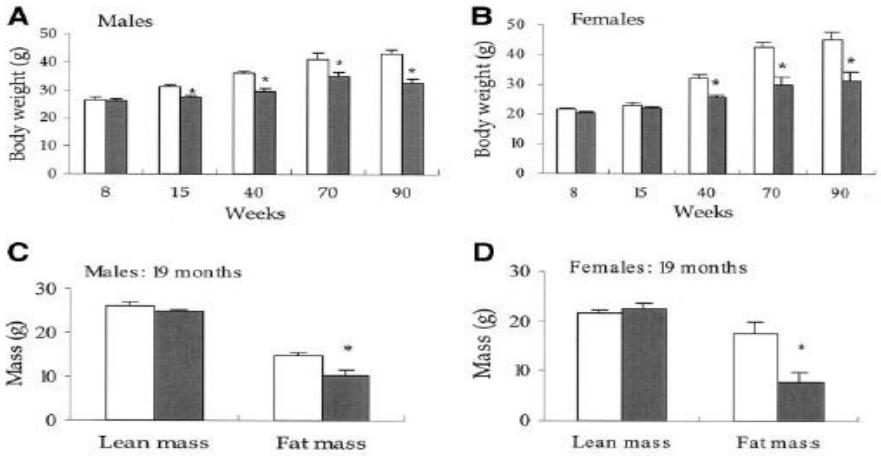
Submitted 23 December 2004; accepted in final form 17 February 2005

* E. Kokkotou and J. Y. Jeon contributed equally to this work.



Am J Physiol Regul Integr Comp Physiol 289: R117–R124, 2005



Original Article

MCH$^{-/-}$ Mice Are Resistant to Aging-Associated Increases in Body Weight and Insulin Resistance

Justin Y. Jeon,[1,2,3,4] Richard L. Bradley,[1,2,3] Efi G. Kokkotou,[1,3,5] Francis E. Marino,[1,2] Xiaomei Wang,[1] Pavlos Pissios,[1,2,3] and Eleftheria Maratos-Flier[1,2,3]

Diabetes 2006 55:428-434

Yonsei University (2005- present)

YONSEI UNIVERSITY

What is the effect of exercise on obesity and obesity associated diseases?

Effect of exercise on insulin resistance and adipocytokines

Effect of lifestyle modification on serum chemerin concentration and its association with insulin sensitivity in overweight and obese adults with type 2 diabetes

Voluntary exercise improves insulin sensitivity and adipose tissue inflammation in diet-induced obese mice

Improved Insulin Sensitivity and Adiponectin Level after Exercise Training in Obese Korean Youth

The association between chemerin and homeostasis assessment of insulin resistance at baseline and after weight reduction via lifestyle modifications in young obese adults

Therapeutic Lifestyle Modification Program Reduces ... of the Chemokin... Subjects With Metabolic Syndrome

Reduced serum vaspin concentrations in obese children following short-term intensive lifestyle modification

... Normal or Impaired Fasting Glucose

The association between pentraxin 3 and insulin resistance in obese children at baseline and after physical activity intervention

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 APRIL 24, 2003 VOL. 348 NO. 17

Overweight, Obesity, and Mortality from Cancer in a Prospectively Studied Cohort of U.S. Adults

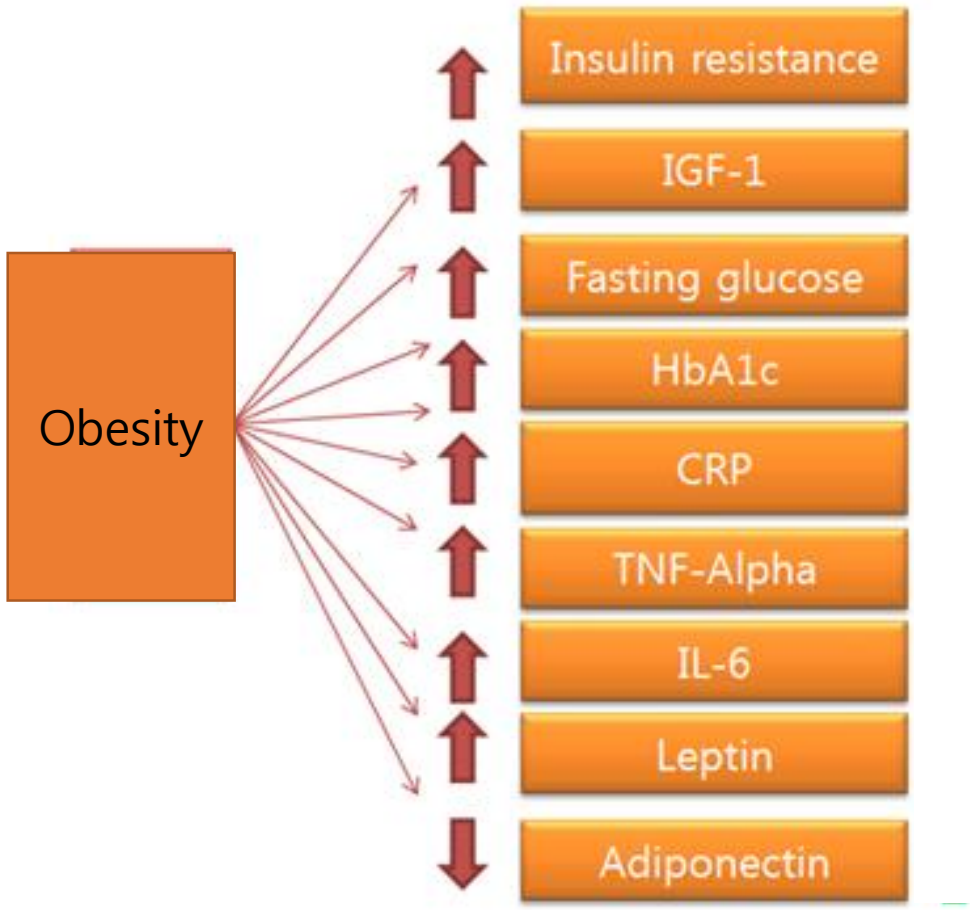
Eugenia E. Calle, Ph.D., Carmen Rodriguez, M.D., M.P.H., Kimberly Walker-Thurmond, B.A., and Michael J. Thun, M.D.

Table 2. Mortality from Cancer According to Body-Mass Index among U.S.Women in the Cancer Prevention Study II, 1982 through 1998.*

Type of Cancer	Body-Mass Index†					P for Trend
	18.5–24.9	25.0–29.9	30.0–34.9	35.0–39.9	≥40.0	
All cancers						
No. of deaths	14,779	7107	2254	517	185	
Death rate‡	329.30	339.75	382.62	419.59	522.51	
RR (95% CI)§	1.00	1.08 (1.05–1.11)	1.23 (1.18–1.29)	1.32 (1.20–1.44)	1.62 (1.40–1.87)	<0.001
Esophageal cancer						
No. of deaths	112	56	21			
Death rate‡	2.56	2.68	2.90			
RR (95% CI)§	1.00	1.20 (0.86–1.66)	1.39 (0.86–2.25)			0.13
Stomach cancer						
No. of deaths	304	134	57	13		
Death rate‡	6.87	6.37	9.88	9.85		
RR (95% CI)§	1.00	0.89 (0.72–1.09)	1.30 (0.97–1.74)	1.08 (0.61–1.89)		0.46
Colorectal cancer						
No. of deaths	1,706	906	312	67	21	
Death rate‡	38.67	43.28	53.81	56.14	63.11	
RR (95% CI)§	1.00	1.10 (1.01–1.19)	1.33 (1.17–1.51)	1.36 (1.06–1.74)	1.46 (0.94–2.24)	<0.001
Breast cancer¶						
No. of deaths	1,446	908	309	68	24	
Death rate‡	39.10	51.13	60.65	67.56	84.86	
RR (95% CI)§	1.00	1.34 (1.23–1.46)	1.63 (1.44–1.85)	1.70 (1.33–2.17)	2.12 (1.41–3.19)	<0.001
Cancer of the corpus and uterus, not otherwise specified‖						
No. of deaths	333	225	105	25	16	
Death rate‡	10.68	15.68	26.05	30.16	60.83	
RR (95% CI)§	1.00	1.50 (1.26–1.78)	2.53 (2.02–3.18)	2.77 (1.83–4.18)	6.25 (3.75–10.42)	<0.001
Cervical cancer						
No. of deaths	80	54	16	14		
Death rate‡	1.73	2.63	2.73	7.81		
RR (95% CI)§	1.00	1.38 (0.97–1.96)	1.23 (0.71–2.13)	3.20 (1.77–5.78)		0.001

Insulin resistance and cancer risk

- Mechanism of obesity associated increase in cancer risk



Effect of exercise on insulin resistance and adipocytokines

ORIGINAL ARTICLE

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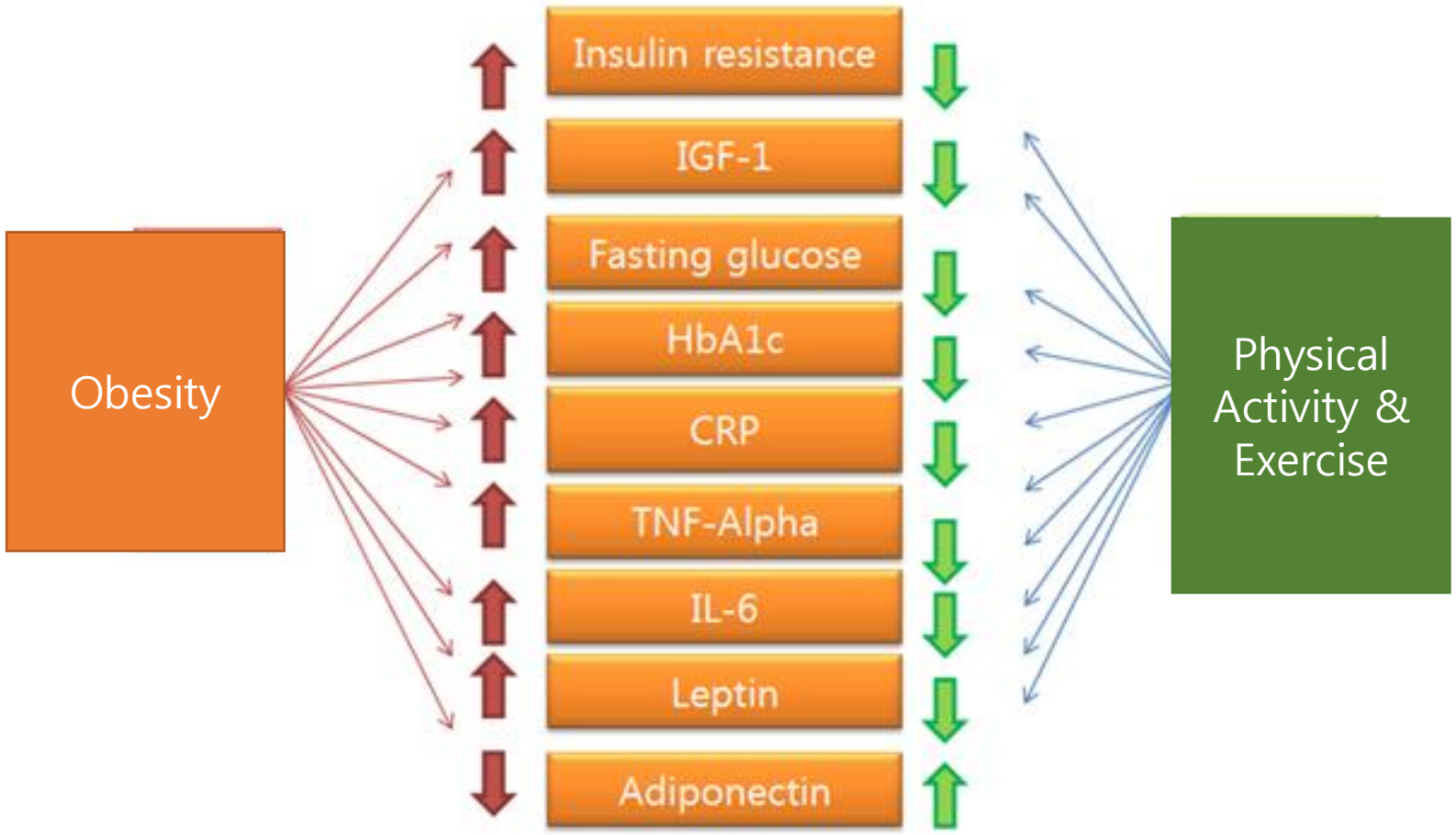
Exercise and Cancer Risk

- Mechanism of exercise associated reduction in cancer risk



If obesity increase the risk of cancer, do exercise and PA reduce the risk of cancer?

Physical Activity and Survival After Breast Cancer Diagnosis

Michelle D. Holmes, MD, DrPH
Wendy Y. Chen, MD
Diane Feskanich, ScD
Candyce H. Kroenke, ScD
Graham A. Colditz, MD, DrPH

Table 2. Age-Adjusted and Multivariable-Adjusted Relative Risks According to Physical Activity Category After Breast Cancer Diagnosis

		Physical Activity After Diagnosis, MET-h/wk					
	Total (N = 2987)	<3 (n = 959)	3-8.9 (n = 862)	9-14.9 (n = 335)	15-23.9 (n = 428)	≥24 (n = 403)	*P* for Trend
Total deaths	463	188	126	38	51	60	
Age-adjusted RR (95% CI)		1.00	0.69 (0.55-0.87)	0.53 (0.37-0.75)	0.56 (0.41-0.77)	0.67 (0.50-0.90)	.004
Multivariable-adjusted RR (95% CI)*		1.00	0.71 (0.56-0.89)	0.59 (0.41-0.84)	0.56 (0.41-0.77)	0.65 (0.48-0.88)	.003
Breast cancer deaths	280	110	84	20	32	34	
Age-adjusted RR (95% CI)		1.00	0.79 (0.60-1.06)	0.47 (0.29-0.76)	0.60 (0.41-0.89)	0.64 (0.44-0.94)	.01
Multivariable-adjusted RR (95% CI)*		1.00	0.80 (0.60-1.06)	0.50 (0.31-0.82)	0.56 (0.38-0.84)	0.60 (0.40-0.89)	.004
Recurrence	370	137	108	29	45	51	
Age-adjusted RR (95% CI)		1.00	0.82 (0.64-1.06)	0.53 (0.35-0.79)	0.66 (0.47-0.93)	0.76 (0.55-1.04)	.05
Multivariable-adjusted RR (95% CI)*		1.00	0.83 (0.64-1.08)	0.57 (0.38-0.85)	0.66 (0.47-0.93)	0.74 (0.53-1.04)	.05

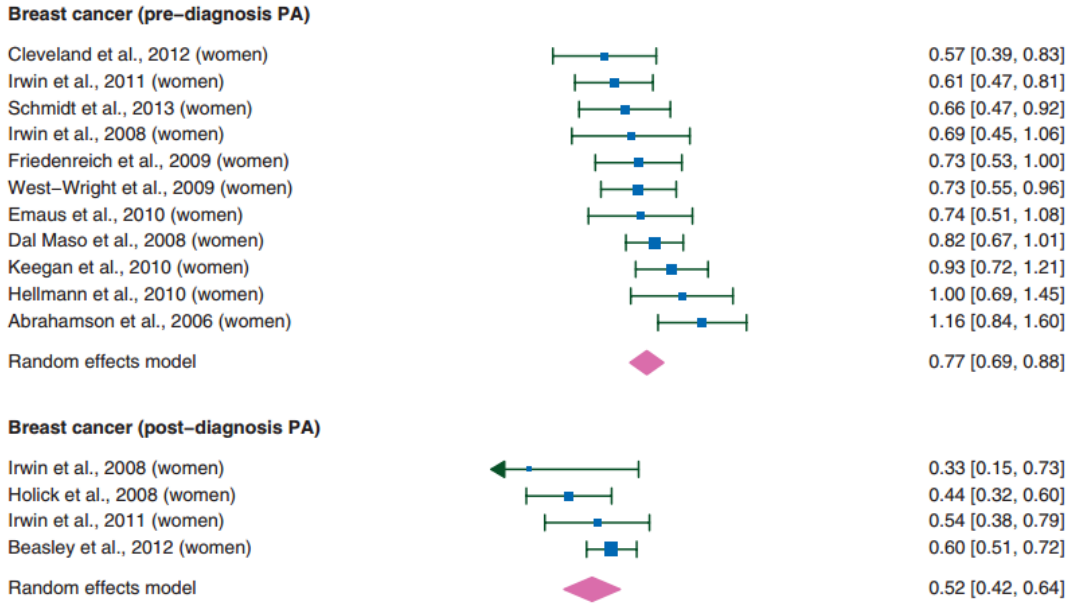
Abbreviations: CI, confidence interval; MET, metabolic equivalent task; RR, relative risk.
*Adjusted for age (months); interval between diagnosis and physical activity assessment (28-33, 34-40, ≥41 mo); smoking status (never, current, past); body mass index (<21, 21-22.9, 23-24.9, 25-28.9, ≥29), which was calculated as weight in kilograms divided by the square of height in meters; menopausal status and hormone therapy use (premenopausal, postmenopausal, and never use; postmenopausal and current use; postmenopausal and past use; uncertain menopausal status; missing); age at first birth and parity (nulliparous, <25 y and 1-2 births, <25 y and ≥3 births, ≥25 y and 1-2 births, ≥25 y and ≥3 births); oral contraceptive use (never, ever, missing); energy intake (quintiles); energy-adjusted protein intake (quintiles); disease stage (I, II, III); radiation treatment (yes or no); chemotherapy (yes or no); and tamoxifen treatment (yes or no).

Compared with breast cancer survivors who do not participate in any PA, breast cancer survivors who participate in PA more than 9 MET hour per week have 50% and 43 % less relative risk of death and recurrence, respectively.

Association between physical activity and mortality among breast cancer and colorectal cancer survivors: a systematic review and meta-analysis

D. Schmid* & M. F. Leitzmann

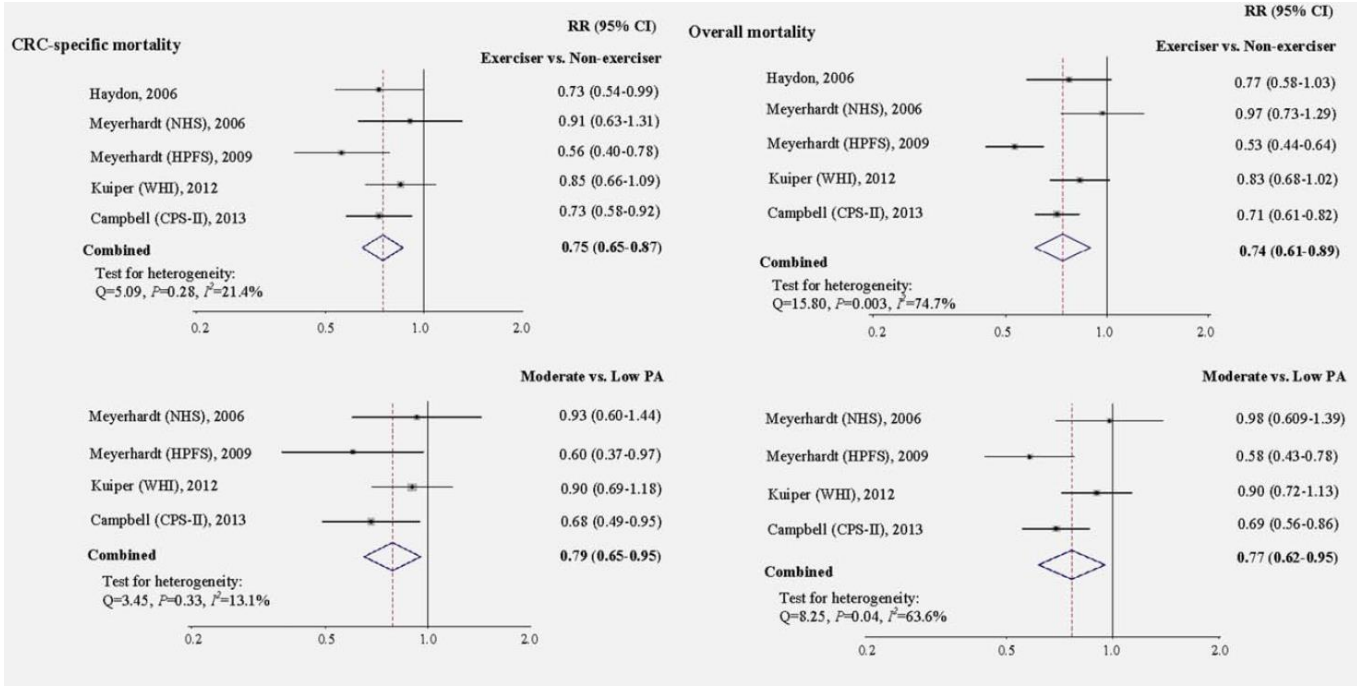
Department of Epidemiology and Preventive Medicine, University of Regensburg, Regensburg, Germany



Association between physical activity and mortality in colorectal cancer: A meta-analysis of prospective cohort studies

Youjin Je[1*], Justin Y. Jeon[2*], Edward L. Giovannucci[3,4] and Jeffrey A. Meyerhardt[5]

IJC
International Journal of Cancer



Post diagnosis PA reduce breast cancer death by 48% and 42% in Breast cancer and colorectal cancer respectively, (Schimid D and Lietzmann, 2013, Je Y and Jeon Y et al. 2013).

Is exercise good for cancer patients?

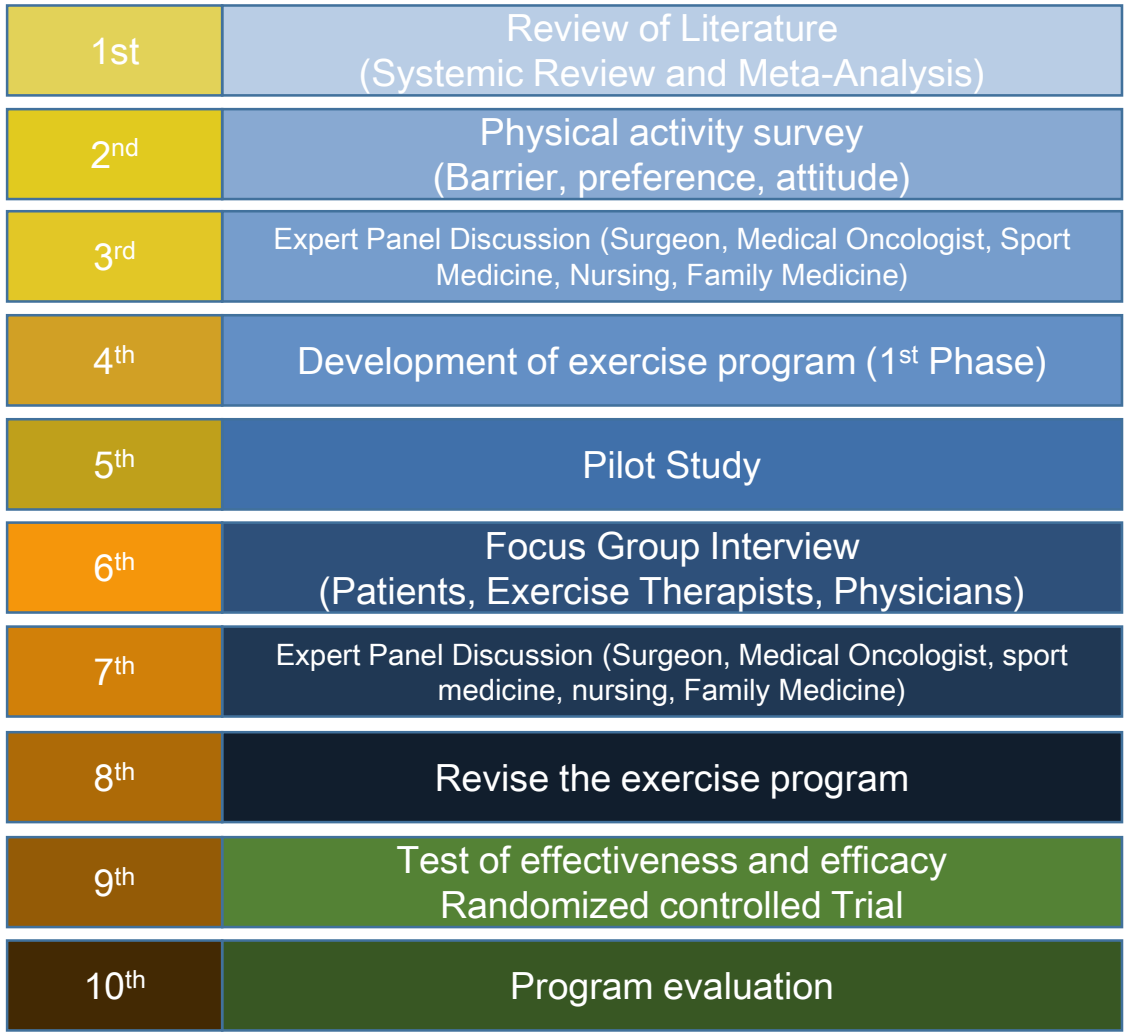
Cancer Trajectory	Expected exercise benefit
Before diagnosis	Cancer Prevention
After diagnosis & Before Treatment	Preparation of cancer therapy
During recovery after surgery	Enhance recovery
During chemo/radiation therapy	Prevention of side effect Improvement of patients' physical function
Hormone Therapy	Prevention of recurrence Recovery from therapy Quality of life
After completion of adjuvant therapy	
After cancer recurrence	Palliation

Is exercise good for cancer patients?

Cancer Trajectory	Expected exercise benefit	Potential mechanism
Before diagnosis	Cancer Prevention	Prevention of Obesity Immune function
After diagnosis & Before Treatment	Preparation of cancer therapy	Factors related to tumor growth Physical fitness improvement
During recovery after surgery	Enhance recovery	Intestine functional recovery Muscle mass maintenance Prevention of insulin resistance
During chemo/radiation therapy	Prevention of side effect Improvement of patients' physical function, completion of chemotherapy	Maintenance of physical function Recovery of urinary incontinence Immune function
Hormone Therapy	Prevention of recurrence Recovery from therapy Quality of life	Prevention of weight gain Muscle mass maintenance Immune function improvement Insulin sensitivity Inflammatory markers Psychological health
After completion of adjuvant therapy		
After cancer recurrence	Palliation	Maintenance of muscle mass Range of motion Psychological health

Let’s develop scientific and evidence based exercise program for cancer survivors!

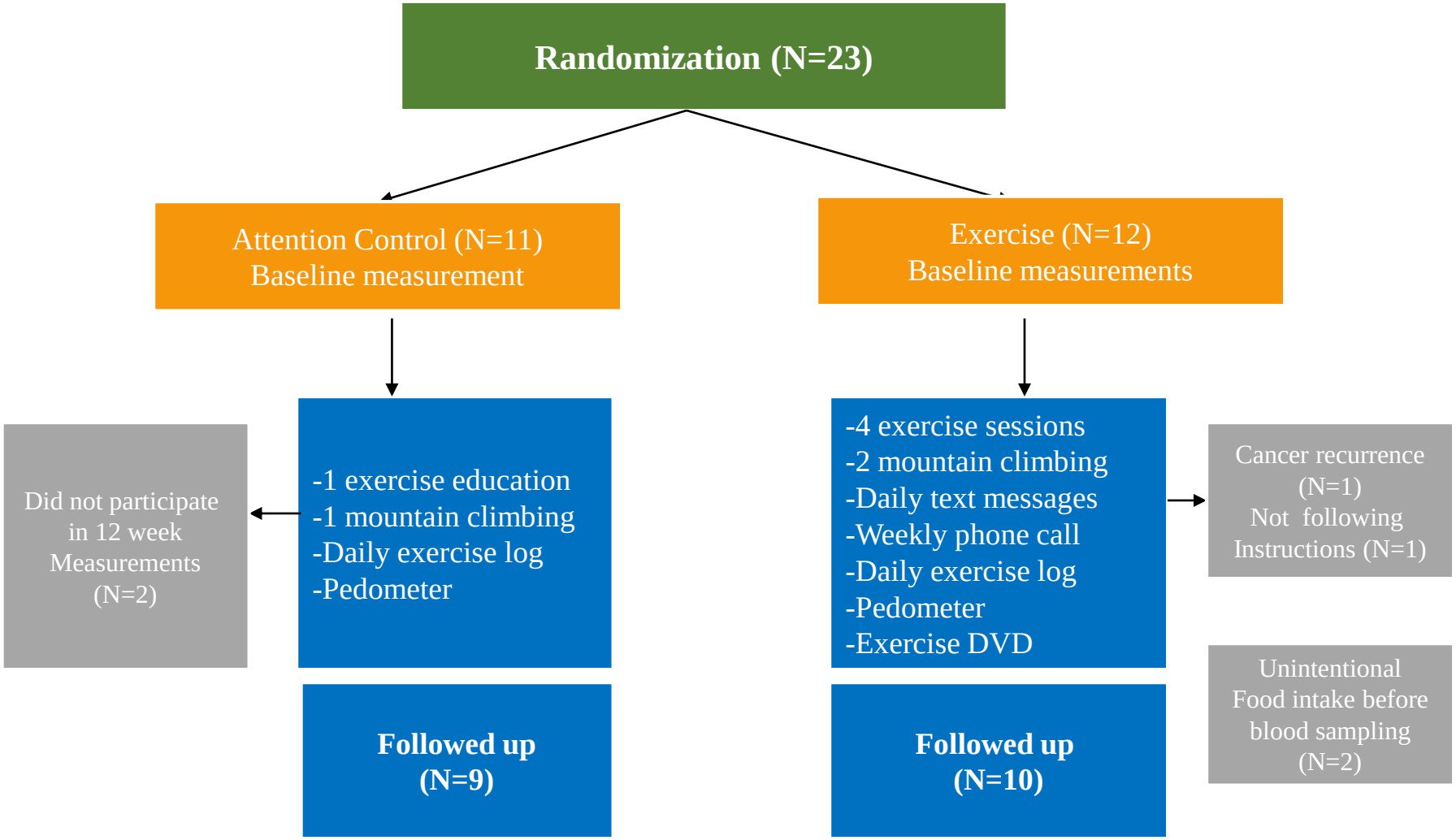
Process of development of evidence based exercise protocol



Jeon and Chu 2010


EXIT
연세대학교
YONSEI UNIVERSITY
NRF Joint Research Program
Dana-Farber/Harvard Cancer Center
Memorial Sloan Kettering Cancer Center
▶Date: May 27~June 3, 2014
Exercise Medicine Center for Diabetes and Cancer Patients, Yonsei University, KOREA

Effects of home-based exercise protocol on the level of physical activity: Randomized Controlled Trial



Effects of home-based exercise protocol on the level of physical activity

	Attention Control		Exercise		
	At baseline	At 12 weeks	At baseline	At 12 weeks	
Vigorous PA (Min)	0	203±252*	22±63	82±76	0.139
Moderate PA (Min)	150±127	284±252	136±439	366±439	0.566
Total PA (Min)	150±127	487±453*	158±114	448±418	0.825
MET-h/wk	10±8	46±45*	12±11	35±27*	0.511

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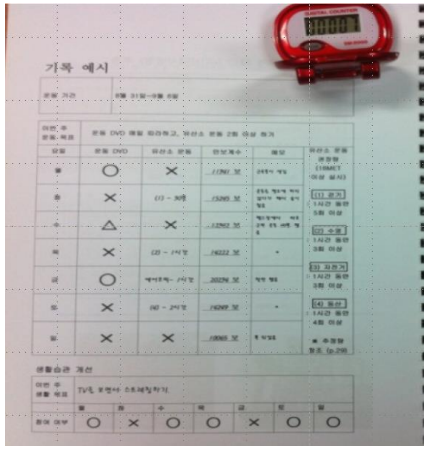
What went wrong with the study?

What went right with the control group?

What did we do for participants in the control group

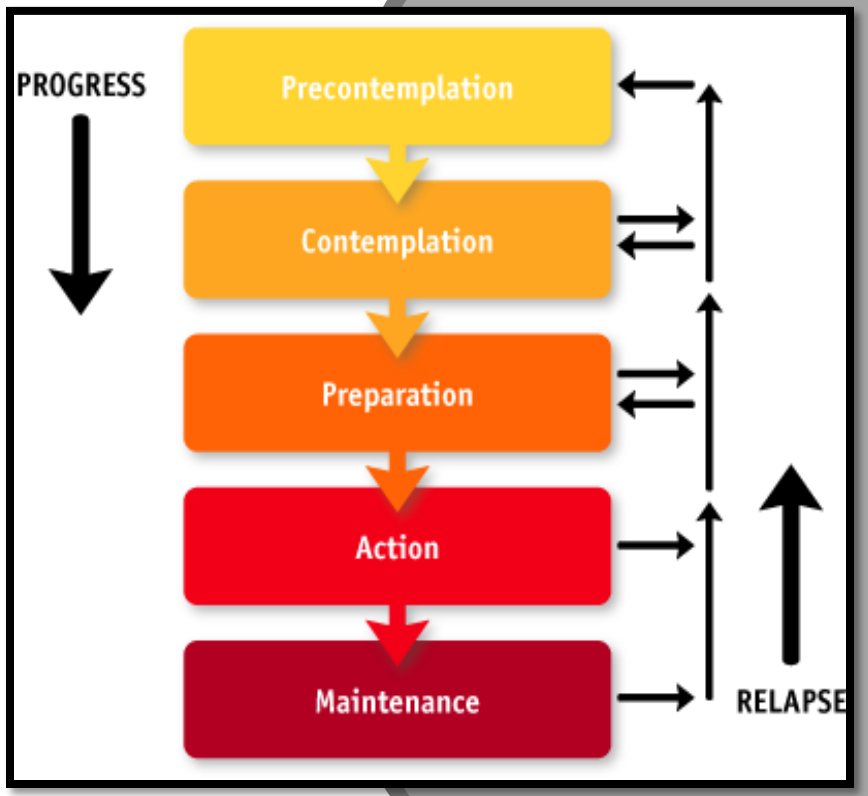
- One exercise education
- Daily Exercise Log
- Pedometer
- Mountain climbing with the Surgeon



Since both exercise and control group participated in the same amount of PA, the control group was contaminated. However, why did control group participate in significantly more amount of PA is of interest.

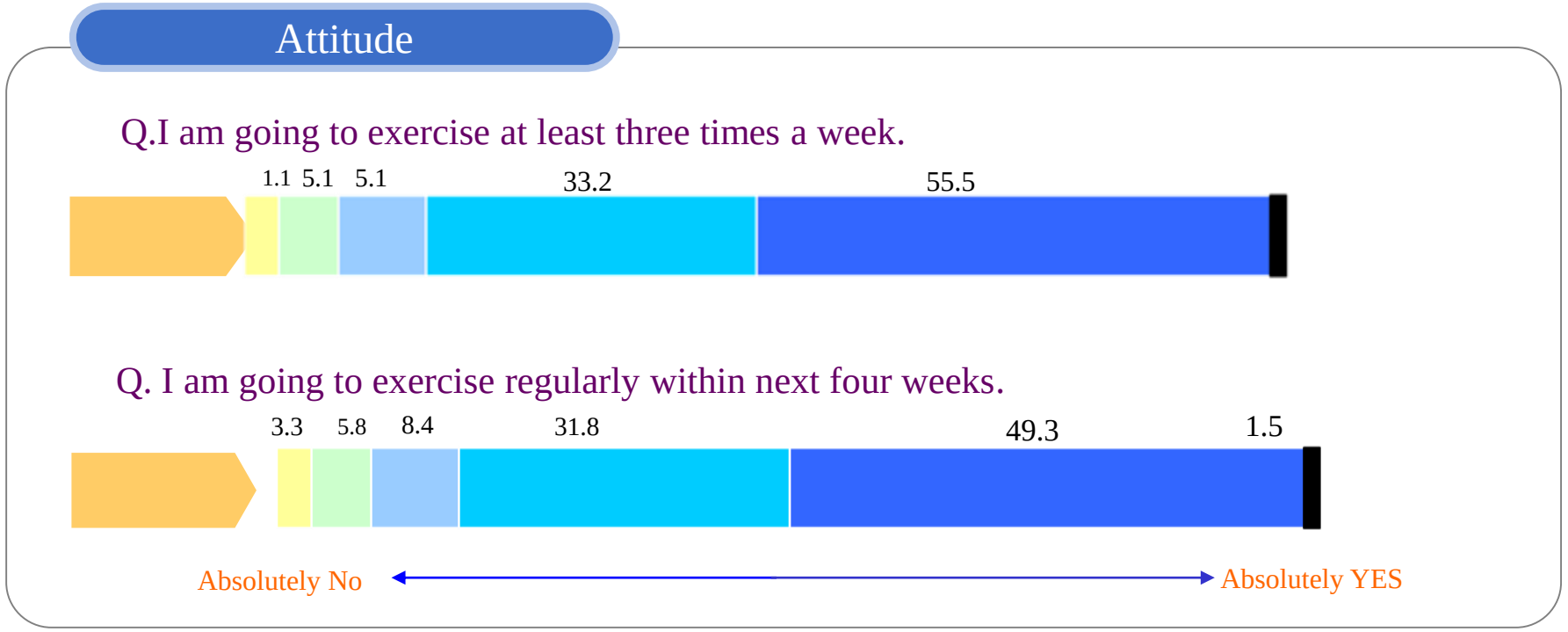
Effects of home-based exercise protocol on the level of physical activity

Exercise stage of change
(Marcus BH and Simkin LR 1994)



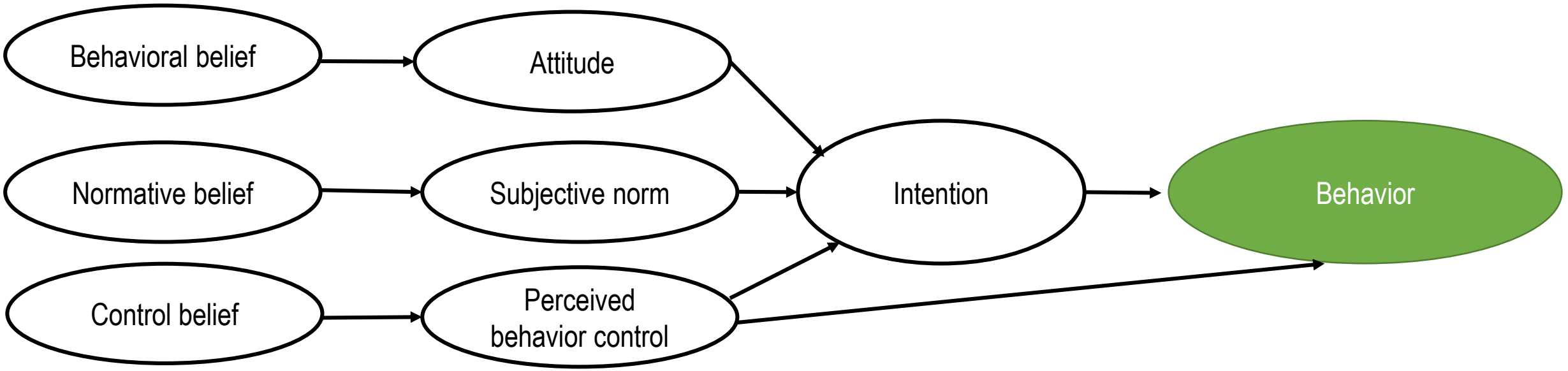
- ❖ Precontemplation
  I was not exercising and I was not thinking about starting in the near future
- ❖ Contemplation
  I was not exercising but I was thinking about starting in the near future
- ❖ Preparation
  I was not exercising regularly but I was exercising occasionally (at least once or twice a week)
- ❖ Action
  I was exercising regularly but had only begun to do so within the last six months
- ❖ Maintenance
  I was exercising regularly and had been doing so for longer than six months

Effects of home-based exercise protocol on the level of physical activity



Almost 90% of cancer patients are either exercising or plan to exercise within next four weeks

Theory of planned behavior



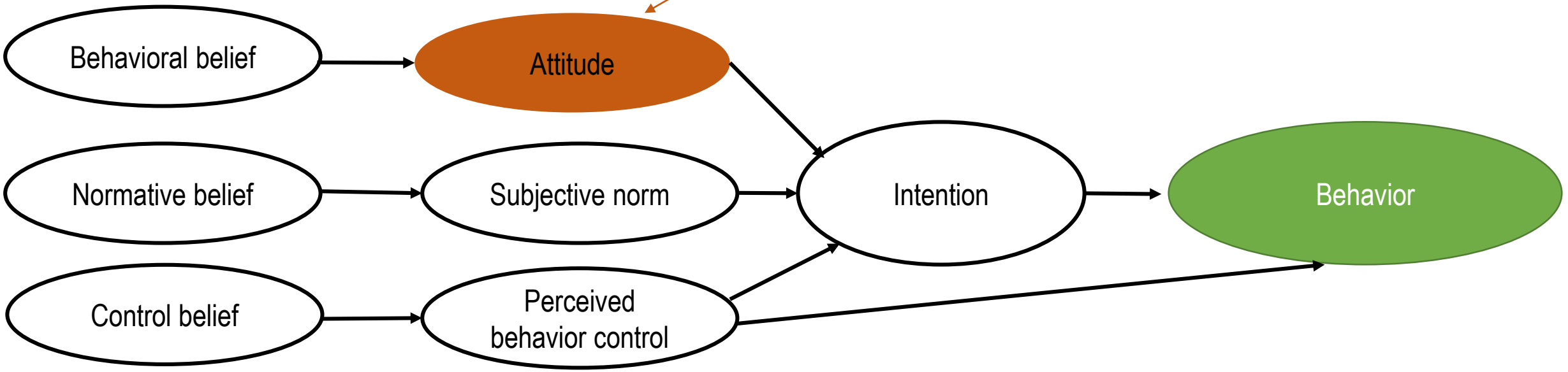
Attitudes are the overall evaluations of the behavior by the individual as positive or negative (What I think about it)

Subjective norm is belief about whether significant others think he/she should engage in the behavior (What others think about it)

Perceived behavior control: Perceived ease of difficulty of performing the particular behavior

Theory of planned behavior

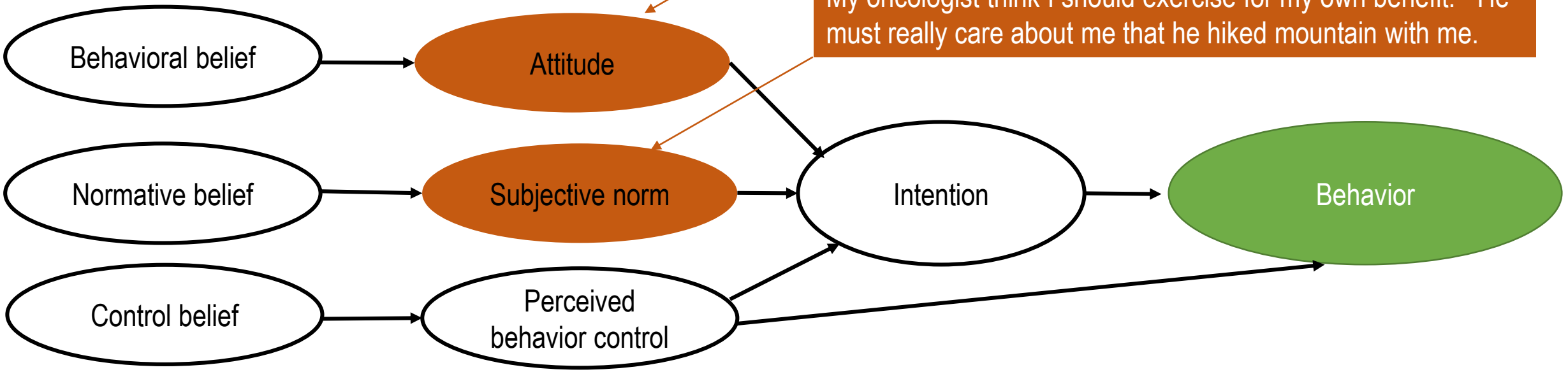
My oncologist and exercise specialist told me that PA can improve prognosis of cancer (Recurrence and survival)



Theory of planned behavior

My oncologist and exercise specialist told me that PA can improve prognosis of cancer (Recurrence and survival)

My oncologist think I should exercise for my own benefit. He must really care about me that he hiked mountain with me.



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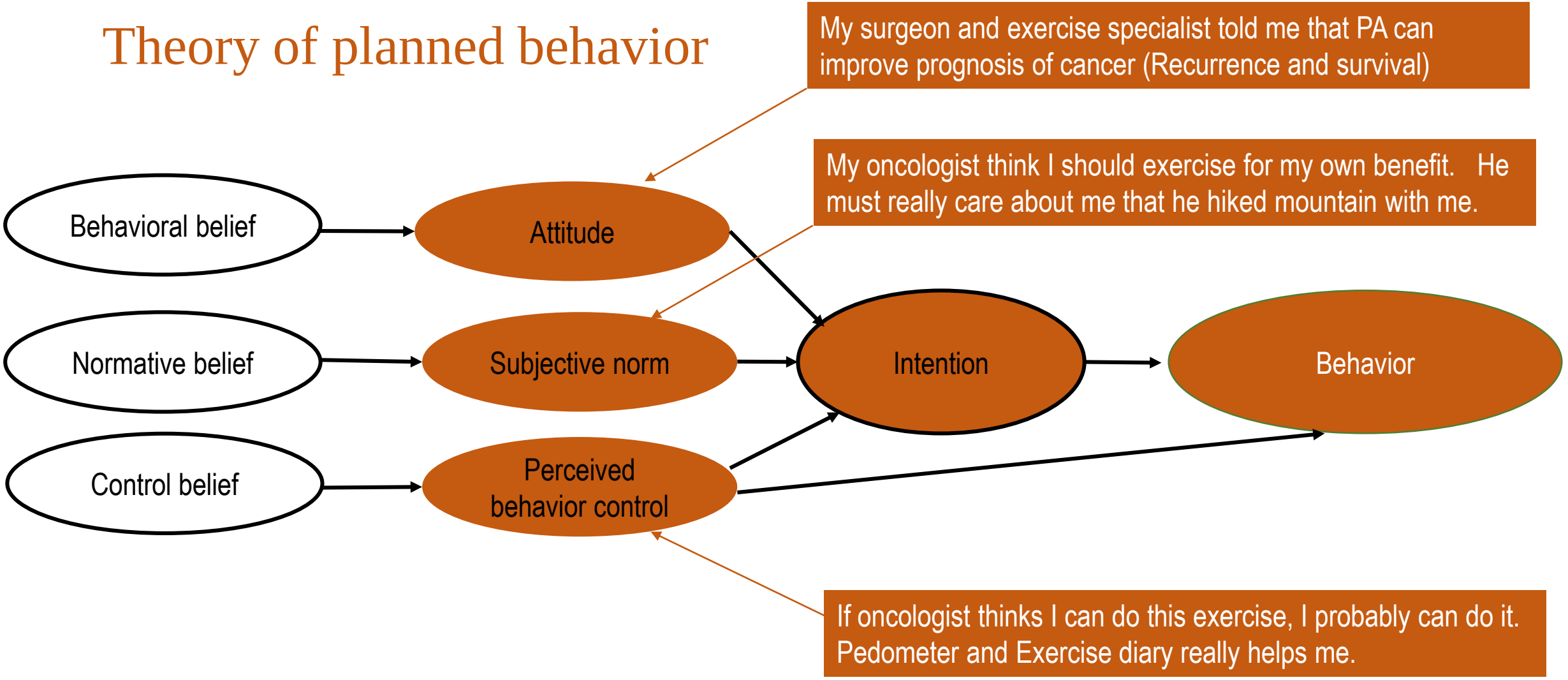

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Effects of home-based exercise protocol on the level of physical activity

	Casually intervene home-based exercise		Intensely Intervene home-based exercise		Attention Control	
	At baseline	At 12 weeks	At baseline	At 12 weeks	*At baseline*	At 12 weeks
Vigorous PA	0	203±252*	22±63	82±76	0±0	0±0
Moderate PA	150±127	284±252	136±439	366±439	42.86±75.21	170.43±255.57
Total PA	150±127	487±453*	158±114	448±418	42.86±75.21	170.43±255.57
MET-h/wk	10±8	46±45*	12±11	35±27*	2.86±5.01	11.43±17.04

No pedometer, No exercise diary and No hiking with the oncologist

Available online at www.sciencedirect.com

Metabolism

www.metabolismjournal.com

Effect of home-based exercise intervention on fasting insulin and Adipocytokines in colorectal cancer survivors: a randomized controlled trial

Mi Kyung Lee[a,h], Ji-Young Kim[a], Dong-Il Kim[a], Dong-Woo Kang[a,k], Ji-hye Park[a], Ki-Yong Ahn[a], Hyuk In Yang[a], Dong Hoon Lee[a,j], Yun Ho Roh[b], Ji-Won Lee[c], Sang-Hui Chu[d], Jeffrey A. Meyerhardt[f], Lee W. Jones[g], Nam-Kyu Kim[e,h,i,*], Justin Y. Jeon[a,h,i,**]

[a] Department of Sport Industry Studies, Exercise Medicine and Rehabilitation Laboratory, Yonsei University, Republic of Korea
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ARTICLE INFO

Article history:
Received 20 April 2017
Accepted 12 July 2017

Keywords:
Colorectal cancer survivors
Home-based exercise program
Insulin
Adipocytokines
Physical function

ABSTRACT

Background and Aims. Elevated circulating insulin is associated with increased risk of recurrence and cancer mortality in early-stage colorectal cancer (CRC). We conducted a randomized controlled trial to determine the effect of a 12-week home-based exercise program on fasting insulin, adipocytokines, and physical function in CRC survivors.

Methods. One hundred and twenty-three stage II-III CRC patients were randomly assigned to either a home-based exercise ($n = 62$) or standard care control group ($n = 61$) for 12 weeks. Home-based exercise consisted of aerobic and resistance training, with a goal of obtaining ≥18 metabolic equivalent task (MET)-h/wk. Participants in the exercise group were instructed to participate in >18 MET-h/wk. of aerobic and resistance exercise while the participants in the control group were asked to maintain their usual daily activity. The primary outcome was fasting insulin levels. Secondary outcomes were adiponectin, TNF-α levels and 6 min walk distance from baseline to post-intervention.

Abbreviations: CRC, Colorectal cancer; MET, Metabolic equivalent task; TNF-α, Tumor necrosis factor-α; TC, Total cholesterol; TG, Triglycerides; HDL-C, High-density lipoprotein cholesterol; hs-CRP, High sensitivity C-reactive protein; LSI, Leisure score index.

Trial Registration number: ISRCTN47234641.

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http://dx.doi.org/10.1016/j.metabol.2017.07.005

Support Care Cancer (2013) 21:2537–2545
DOI 10.1007/s00520-013-1822-7

ORIGINAL ARTICLE

Effects of a 12-week home-based exercise program on the level of physical activity, insulin, and cytokines in colorectal cancer survivors: a pilot study

Dong Hoon Lee · Ji Young Kim · Mi Kyung Lee · Choae Lee · Ji-Hee Min · Duck Hyoun Jeong · Ji-Won Lee · Sang Hui Chu · Jeffrey A. Meyerhardt · Jennifer Ligibel · Lee W. Jones · Nam Kyu Kim · Justin Y. Jeon

Received: 18 January 2013 / Accepted: 11 April 2013 / Published online: 2 May 2013

Abstract
Purpose The purposes of this study are to examine (1) the feasibility and efficacy of two different home-based exercise protocols on the level of physical activity (PA), and (2) the effect of increased PA via home-based exercise program on biomarkers of colorectal cancer.
Methods Seventeen patients (age 55.18 ± 13.3 years) with stage II–III colorectal cancer completed the 12-week home-based exercise program. Subjects were randomized into either casually intervened home-based exercise group (CIHE) or intensely intervened home-based exercise group (IIHE). The primary outcome was the level of PA. Furthermore, insulin, homeostasis model assessment of insulin resistance, insulin-like growth factor axis, and adipocytokines were measured.
Results Both CIHE and IIHE program significantly increased the level of PA at 12 weeks compared to its level at baseline (CIHE, 10.00±8.49 vs. 46.07±45.59; IIHE, 12.08±11.04 vs. 35.42±27.42 MET hours per week). Since there was no difference in PA change between groups (p=0.511), the data was combined in analyzing the effects of increased PA on biomarkers. Increase in PA significantly reduced insulin (6.66±4.58 vs. 4.86±3.48 μU/ml, p=0.006), HOMA-IR (1.66±1.23 vs. 1.25±1.04, p=0.017), and tumor necrosis alpha-α (TNF-α 4.85±7.88 vs. 2.95±5.38 pg/ml, p=0.004), and significantly increased IGF-1 (135.39±60.15 vs. 159.53 ng/ml, p=0.007), IGF binding protein (IGFBP)-3 (2.67±1.48 vs. 3.48±1.00 ng/ml, p=0.013), and adiponectin (6.73±3.07 vs. 7.54±3.96 μg/ml, p=0.015).
Conclusion CIHE program was as effective as IIHE program in increasing the level of PA, and the increase in PA resulted in significant change in HOMA-IR, IGF-1 axis, TNF-α, and adiponectin levels in stage II–III colorectal cancer survivors.

Keywords Colorectal cancer · Exercise · Insulin resistance · IGFs · Cytokine

Dong Hoon Lee and Ji Young Kim contributed equally to this work.

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Introduction

Colorectal cancer is the third most common cancer in South Korea and the fourth common cancer worldwide [15, 33].

Park *et al. BMC Cancer* (2015) 15:249
DOI 10.1186/s12885-015-1250-9

BMC Cancer

RESEARCH ARTICLE Open Access

Characteristics of attitude and recommendation of oncologists toward exercise in South Korea: a cross sectional survey study

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- Questionnaires obtained from Annual conference of Korean cancer association (202 questionnaires distributed and 44 questionnaires were returned
- E-mail addresses of oncologists in South Korea were obtained then 386 emails were sent and 123 replied with answers to the questionnaires

Table 1 Demographic characteristics

Variable		No. of respondents	%	Mean ± SD
Age (years)		167		43.0 ± 8.6
Number of years in practice		167		10.5 ± 8.0
Sex	Male	111	66.5	-
	Female	56	33.5	
Specialty	Surgeon	41	24.6	-
	Medical oncology	78	46.7	
	Radiation oncology	25	15.0	
	Other	21	12.6	
Type of cancer patients (Multiple response) No:275	Colorectal cancer	63	22.9	-
	Gastric cancer	51	18.5	
	Breast cancer	47	17.0	
	Lung cancer	46	16.7	
	Liver cancer	27	9.8	
	Other	41	14.9	
How many cancers do you take care of	One cancer	91	54.5	-
	Two cancers	47	28.1	
	Over 3 cancers	25	15.1	
Exercise (min/week)	Mild exercise	167		80.1 ± 85.6
	Moderate exercise	167		44.1 ± 62.8
	Vigorous exercise	167		15.4 ± 48.1
	Total exercise	167		139.5 ± 120.3
	Meeting exercise guidelines	19	11.4%	

Values given as mean ± SD for continuous variables and frequency (%) for categorical variables.
ACSM guidelines: At least 150 minutes of vigorous to moderate intensity physical activity per week.

Relatively young

Various types of cancer

Small portion meet PA guideline

Table 2 Attitudes toward exercise and recommending exercise for cancer patients

Survey item		Mean ± SD	Disagree		Neutral		Agree	
			N	%	N	%	N	%
Attitudes toward exercise	In my opinion exercise is beneficial during treatment.	5.9 ± 1.4	5	4.0	28	22.4	91	72.8
	In my opinion exercise is important during treatment.	5.9 ± 1.3	5	4.0	32	25.6	87	69.6
	In my opinion exercise is safe during treatment.	5.1 ± 1.3	3	2.4	71	56.3	49	39.2
	Most patients believe they should exercise during cancer treatment.	5.38 ± 1.41	5	4.0	51	40.8	69	55.2
	Most fellow oncologists think patients should exercise during cancer treatment.	4.8 ± 1.4	10	8.0	76	60.8	39	31.2
	Most of my patients are capable of exercising during cancer treatment.	4.9 ± 1.5	9	7.2	67	53.6	49	39.3
	Exercising during treatment for my patients is easy.	3.9 ± 1.1.4	10	15.2	91	72.8	15	12.0
Attitudes toward recommending exercise	Providing an exercise recommendation would be well received.	5.1 ± 1.2	3	1.8	96	57.5	68	40.7
	If I provided a recommendation, patients would follow my advice.	4.9 ± 1.1	3	1.8	115	68.9	49	29.3
	My fellow oncologists think I should recommend exercise.	5.6 ± 1.3	6	3.6	61	36.5	100	59.9
	My patients think I should recommend exercise.	5.1 ± 1.4	8	4.8	91	54.5	68	40.7
	Whether I recommend exercise is completely up to me.	4.6 ± 1.5	17	10.2	99	59.3	50	29.9
	When appropriate, I try to recommend exercise.	4.6 ± 1.6	21	12.6	93	55.7	53	31.7
	For me, providing a recommendation is easy.	5.1 ± 1.4	9	5.4	83	49.7	75	44.9
			0 ~ 33%		34 ~ 67%		68 ~ 100%	
	What % of your patients in your opinion try to exercise during cancer treatment?	44.8 ± 20.5	47	37.6	51	40.8	19	15.2
	What % of your patients in your opinion manage to exercise during cancer treatment?	33.6 ± 19.0	75	60	31	24.8	9	7.2

Values given as mean ± SD for continuous variables and frequency (%) for categorical variables. All items rated on 7-point Likert scale: Disagree (responses 1–2), Neutral I (responses 3–5), Agree (responses 6–7).

Exercise is beneficial and important but may not be safe

Exercise during treatment is not easy

Most patients may not manage to exercise during treatment

Table 3 Attitudes toward exercise and toward recommending exercise across oncologists' own physical activity levels

		Physical activity level (Tertiles)		
		Low (N = 56)	Middle (N = 52)	High (N = 58)
Attitudes toward exercise	In my opinion exercise is beneficial during treatment.	5.80 ± 1.43	5.85 ± 1.35	5.93 ± 1.39
	In my opinion exercise is important during treatment.	5.64 ± 1.50	5.90 ± 1.11	6.02 ± 1.20
	In my opinion exercise is safe during treatment.	5.00 ± 1.34	5.22 ± 1.27	5.21 ± 1.25
	Most patients believe they should exercise during cancer treatment.	5.21 ± 1.46	5.25 ± 1.49	5.67 ± 1.25
	Most fellow oncologists think patients should exercise during cancer treatment.	4.68 ± 1.39	4..70 ± 1.49	5.02 ± 1.32
	Most of my patients are capable of exercising during cancer treatment.	4.71 ± 1.59	4.81 ± 1.36	5.17 ± 1.47
	Exercising during treatment for my patients is easy.	3.71 ± 1.40	4.04 ± 1.39	3.88 ± 1.42
Attitudes toward recommending exercise	Providing an exercise recommendation would be well received.	5.14 ± 1.17	5.04 ± 1.14	5.19 ± 1.15
	If I provided a recommendation, patients would follow my advice.	4.79 ± 1.14	4.83 ± 1.11	4.93 ± 1.11
	My fellow oncologists think I should recommend exercise.	5.43 ± 1.26	5.36 ± 1.43	5.91 ± 1.22
	My patients think I should recommend exercise.	4.73 ± 1.40	5.04 ± 1.45	5.40 ± 1.38*
	Whether I recommend exercise is completely up to me.	4.18 ± 1.54	4.48 ± 1.42	4.98 ± 1.32*
	When appropriate, I try to recommend exercise.	4.50 ± 1.50	4.57 ± 1.54	4.78 ± 1.64
	For me, providing a recommendation is easy.	4.80 ± 1.37	5.04 ± 1.44	5.55 ± 1.33*
Exercise recommendations	Exercise recommendation to their cancer patients.	41.80 ± 24.63	41.73 ± 30.01	51.57 ± 29.16

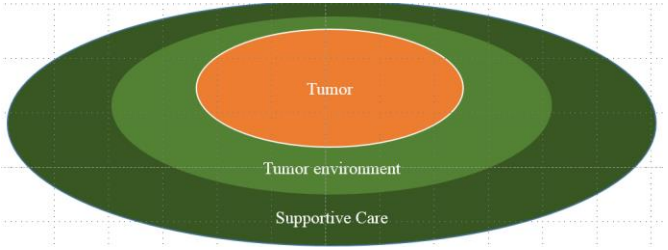
Values given as mean ± SD. Physical activity level (Low PA group: 0 ~ 70 minutes/week, middle PA group: 71 ~ 165 minutes/week, high PA group: 166 ~ 540 minutes/week). *Significant difference with low PA.

More physically active oncologists have better attitude toward recommending exercise

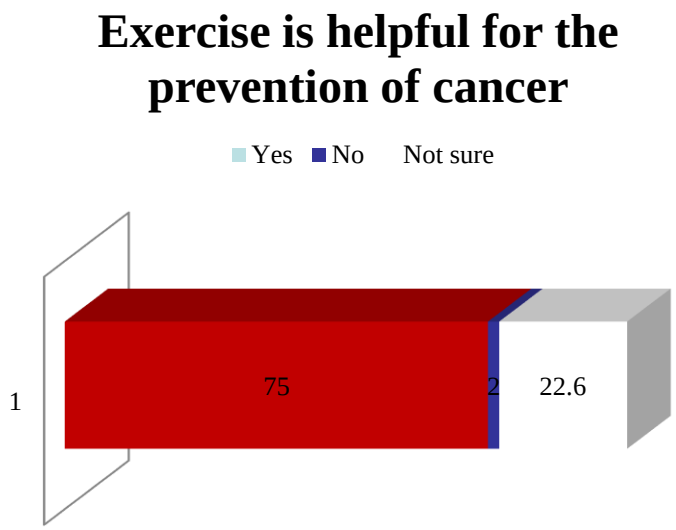
Table 4 Descriptive analysis of oncologists' exercise recommendations

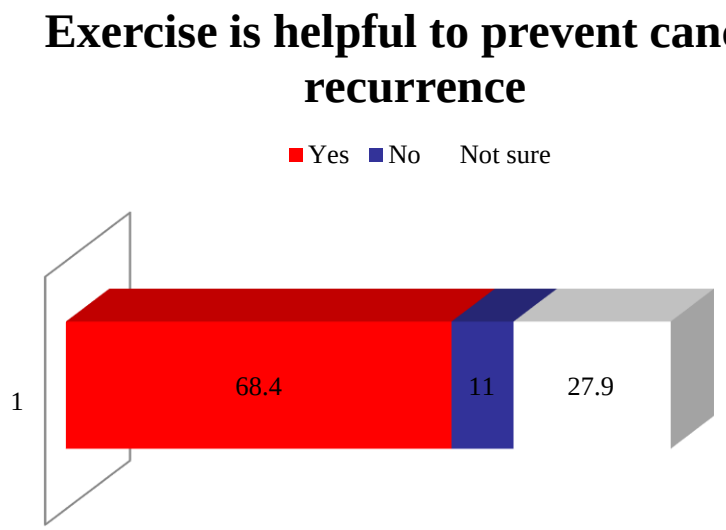
Variable		Mean ± SD
What percentage of your patients have initiated a discussion with you about exercise during cancer treatment over the past month?		29.5 ± 22.4
What percentage of your patients have you recommended exercise to during cancer treatment over the past month?		45.0 ± 28.2
On average, if a patient initiates a discussion with you on exercise, how long do you spend discussing this topic? (min)		4.3 ± 2.9
Benefits of exercise for cancer survivors (Multiple response)		
	N	%
Improve the ability to perform daily tasks	128	26.7
Improve mental health	118	24.6
Attenuate physical decline from treatment	92	19.2
Reduce body weight	44	9.2
Reduce the risk of other diseases	37	7.7
Help patients cope	34	7.1
Reduce the risk of recurrence	23	4.8
No recommendation	2	0.4
Other	1	0.2
Total	479	100

Small portion of oncologists know that exercise reduce the risk of other disease and cancer recurrence



Attitude toward physical activity and exercise





Jeon et al. 2012 Unpublished data

Barriers to recommending exercise for cancer survivors (Multiple response)

	N	%
Lack of time during office visit	40	24.0
Unclear recommendations	35	21.0
Concerns about the safety of exercise	34	20.4
Lack of patient interest	13	7.8
Concerns about the effectiveness of exercise	7	4.2
Lack of reimbursement for counseling on exercise	6	3.6
Enough recommendations	32	19.2
Total	479	100

Values given as mean ± SD for continuous variables and frequency (%) for categorical variables.

What if we solve these three problems:

- Lack of time- Oncologists refer to Exercise Specialists
- Unclear recommendation- Provide clear recommendation
- Concerns about the safety of exercise- Develop evidence based exercise which is safe and effective

Original Article

The Effect of Oncologists' Exercise Recommendations on the Level of Exercise and Quality of Life in Survivors of Breast and Colorectal Cancer: A Randomized Controlled Trial

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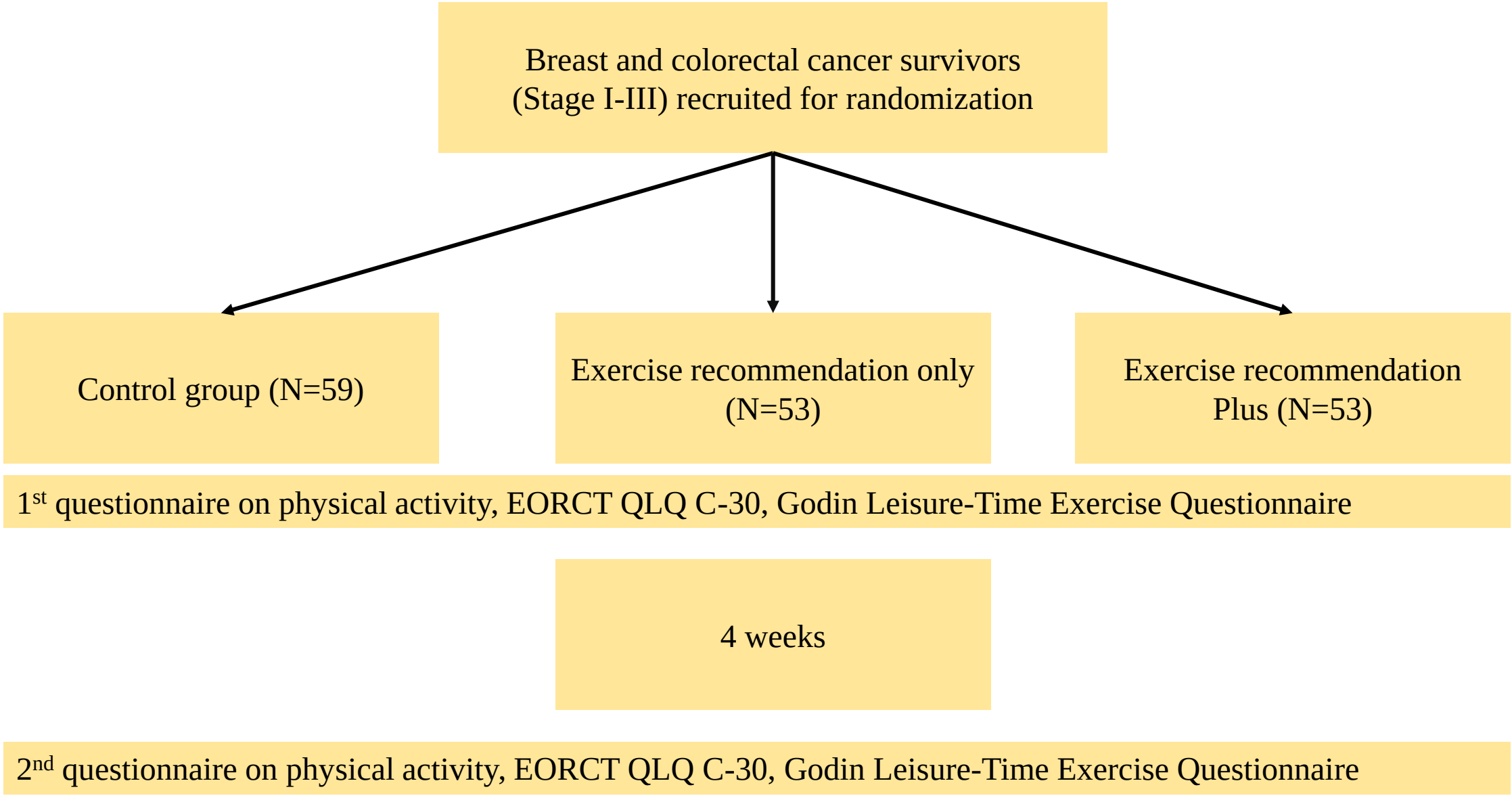
Cancer 2015;121:2740-8

TABLE 1. Demographic and Medical Characteristics of the Participants[a]

Characteristic		Total (N=162)	Control (N=59)	Oncologist's Exercise Recommendation (N=53)	Oncologist's Exercise Recommendation With Exercise Motivation Package (N=50)	*P*
Demographics	Male sex	19 (11.7)	9 (15.3)	5 (9.4)	5 (10.0)	.571
	Age, y	51.80±8.02	53.42±8.12	51.38±7.24	50.32±8.48	.118
	Married	13.6 (84)	48 (81.4)	46 (86.8)	42 (84.0)	.736
	Family income >$50,000/y	36 (22.2)	13 (22.0)	11 (20.8)	12 (24.5)	.748
	Completed university/college	62 (38.3)	21 (35.6)	23 (43.3)	18 (36.7)	.666
	Employed full time	64 (39.5)	24 (42.1)	21 (42.0)	19 (38.8)	.928
Medical Characteristics	Weight, kg	57.47±9.76	57.39±8.98	57.90±9.76	57.16±10.77	.927
	BMI, kg/m^2	22.72±3.32	22.76±3.47	22.91±3.17	22.47±3.34	.796
	Tumor site					
	Breast	122 (75.3)	41 (69.5)	42 (79.2)	39 (78.6)	.425
	Colorectal	40 (24.7)	18 (30.5)	11 (20.8)	11 (22.0)	
	Stage of disease (N=148)					
	I	66 (40.7)	22 (40.0)	25 (49.0)	19 (45.2)	.877
	II	51 (31.5)	21 (38.2)	15 (29.4)	15 (35.7)	
	III	31 (19.1)	12 (21.8)	11 (21.6)	8 (19.0)	
	Time since diagnosis, mo	23.12±9.36	24.00±8.93	23.04±9.80	22.11±9.48	.613
	Time since surgery, mo	20.35±8.78	21.53±8.18	20.20±9.41	19.11±8.78	.401

Abbreviation: BMI, body mass index.

[a] Data are presented as either the number (%) or as the mean ± the standard deviation.


Breast and colorectal cancer survivors
(Stage I-III) recruited for randomization
Control group (N=59)
Exercise recommendation only
(N=53)
Exercise recommendation
Plus (N=53)
1st questionnaire on physical activity, EORCT QLQ C-30, Godin Leisure-Time Exercise Questionnaire
4 weeks
2nd questionnaire on physical activity, EORCT QLQ C-30, Godin Leisure-Time Exercise Questionnaire

Recommendation

Oncologist's exercise recommendation

The oncologists read the following recommendation to their participants:

"Studies showed that the participation in moderate physical activity more than 150 minutes per week could reduce breast and colorectal cancer recurrence significantly. Therefore, it is highly recommended for breast and colorectal cancer survivors to participate in at least 150 minutes of moderate level physical activity and twice a week of strengthening exercise."

Recommendation Plus

Exercise motivation package

The exercise motivation package included exercise DVDs, a pedometer, an exercise diary, and a 15-minute exercise education session.

Exercise DVDs

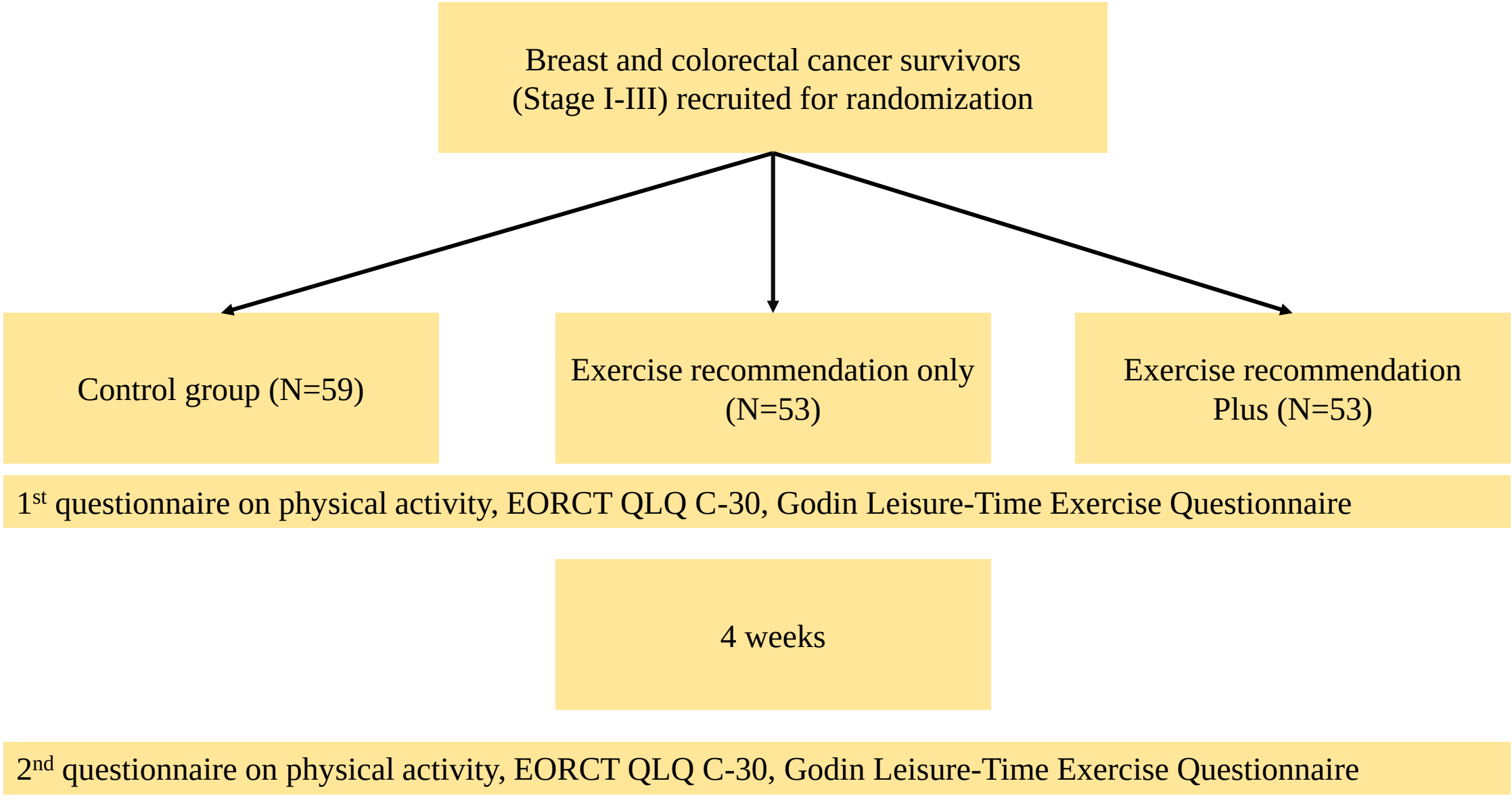
Two different DVDs were provided to participants. Exercises in the DVDs consisted of 3 sets of either 5 or 7 different exercises using their own body weight (see Supporting Information Table 1).

Exercise diary

The exercise diary included columns that helped participants to keep track of their exercise and the number of steps walked per day.

Exercise education

One 15-minute exercise education session that covered how to use the exercise motivation package was conducted. The exercise physiologist explained the benefit of exercise on cancer prognosis.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Exercise recommendation only
(N=53)
Exercise recommendation
Plus (N=53)
1st questionnaire on physical activity, EORCT QLQ C-30, Godin Leisure-Time Exercise Questionnaire
4 weeks
2nd questionnaire on physical activity, EORCT QLQ C-30, Godin Leisure-Time Exercise Questionnaire

TABLE 3. Mean Change in Level of Exercise and EORTC QLQ-C30 Between Groups[a]

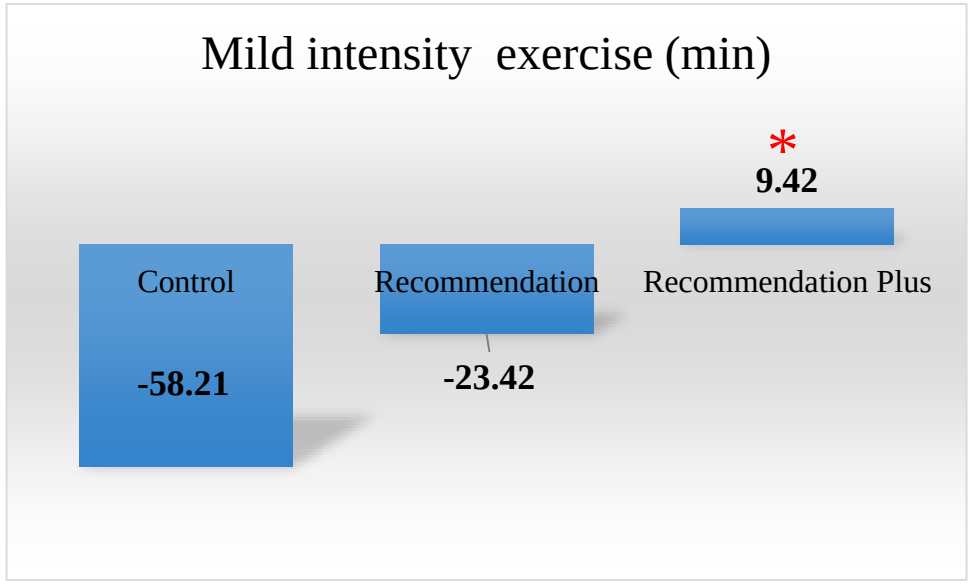
Variable		Control (N=59)	Oncologist's Exercise Recommendation(N=53)	Oncologist's Exercise Recommendation With Exercise Motivation Package (N=50)	*P*
Exercise, min/wk	Strenuous intensity exercise	−3.56 (−8.61 to 1.49)	4.53 (−9.92 to 18.98)	0.00 (0.00-0.00)	.422
	Moderate intensity exercise	10.34 (−6.25 to 26.93)	16.79 (−4.54 to 38.12)	40.22 (15.88-64.57)[b]	<.001
	Mild intensity exercise	−47.35 (−96.89 to 2.18)	−20.33 (−65.68 to 25.02)	7.35 (−28.41 to 43.11)	.351
	Total exercise	−39.05 (−8.28 to 11.18)	0.99 (−40.71 to 42.69)	47.57 (9.62-85.52)[b]	.022
	MET-h/wk	−1.81 (−4.53 to .91)	1.06 (−1.65 to 3.78)	4.14 (1.70-6.58)[b]	.004
QoL	Global health status/QoL	−0.56 (−5.23 to 4.10)	1.10 (−3.34 to 5.54)	1.67 (−2.22 to 5.55)	.937
	Physical functioning	6.55 (3.35-9.75)	6.16 (2.90-9.42)	6.00 (1.93-10.07)	.870
	Role functioning	0.56 (−4.47 to 5.60)	0.31 (−4.66 to 5.29)	9.00 (3.48-14.51)[b,c]	.014
	Emotional functioning	5.23 (1.64-8.81)	3.46 (−1.66 to 8.58)	4.33 (0.18-8.48)	.742
	Cognitive functioning	3.11 (−0.80 to 7.01)	3.46 (−1.50 to 8.42)	5.10 (1.55-8.65)	.635
	Social functioning	5.93 (0.07-11.79)	−0.63 (−7.78 to 6.52)	1.33 (−5.42 to 8.09)	.143
	Fatigue	−10.73 (−15.51 to −5.96)	−2.72 (−7.17 to 1.72)	−7.78 (−12.65 to −2.91)	.061
	Nausea and vomiting	−1.69 (−3.93 to 0.54)	0.31 (−2.15 to 2.78)	−1.67 (−5.28 to 1.94)	.559
	Pain	−2.26 (−7.06 to 2.54)	−6.60 (−12.67 to −0.54)	−7.00 (−10.59 to −3.41)	.087
	Dyspnea	−3.95 (−8.25 to 0.34)	−3.14 (−8.32 to 2.03)	−1.33 (−6.73 to 4.07)	.731
	Insomnia	−0.56 (−6.49 to 5.36)	−10.06 (−17.18 to −2.95)	−1.33 (−17.57 to 14.90)	.109
	Appetite loss	−4.52 (−11.06 to 2.02)	−2.51 (−7.23 to 2.20)	−9.33 (−15.09 to −3.58)	.151
	Constipation	−2.26 (−5.82 to 1.30)	−0.63 (−8.16 to 6.91)	−3.33 (−8.12 to 1.45)	.787
	Diarrhea	−3.39 (−6.49 to −0.29)	−1.26 (−4.84 to 2.33)	−9.33 (−14.76 to −3.91)[c]	.032
	Financial difficulties	2.82 (−3.05 to 8.70)	−3.14 (−9.19 to 2.90)	−2.67 (−6.42 to 1.08)	.197

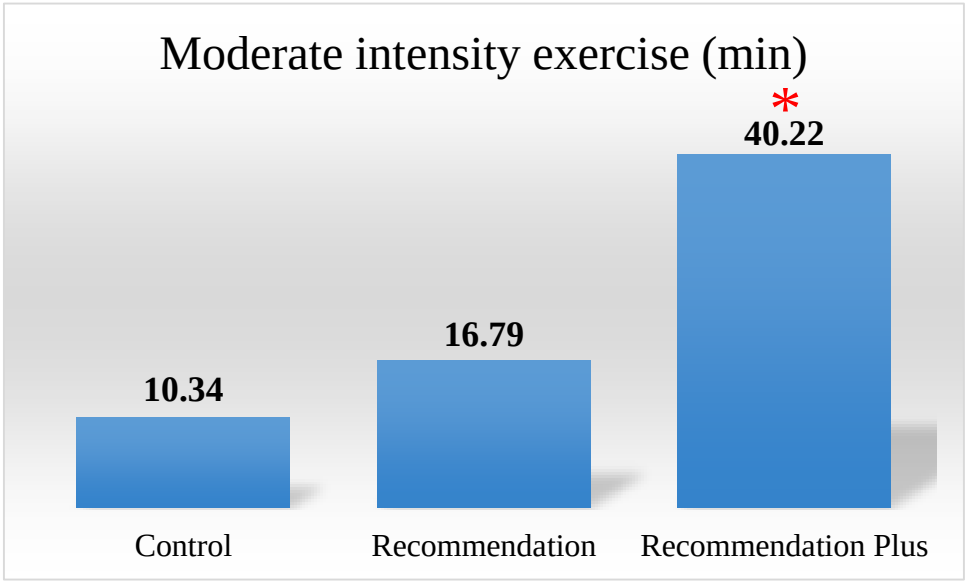
Abbreviations: EORTC QLQ-30, European Organization for Research and Treatment of Cancer QLQ C-30 instrument; MET, Metabolic Equivalent of Task; QoL, quality of life.

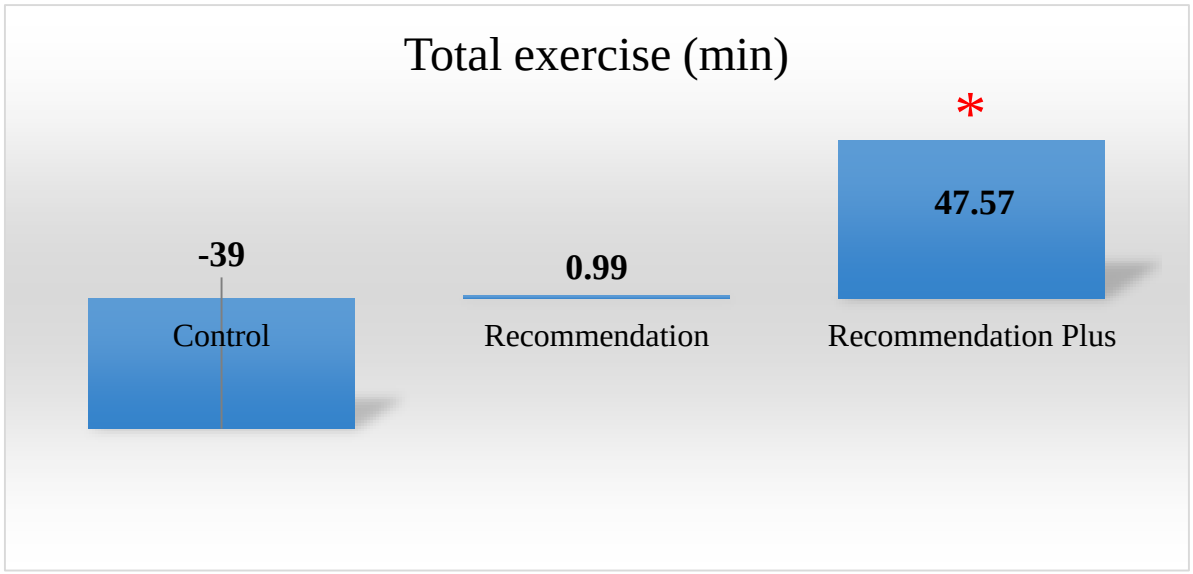
[a] Data are presented as the delta (95% confidence interval).

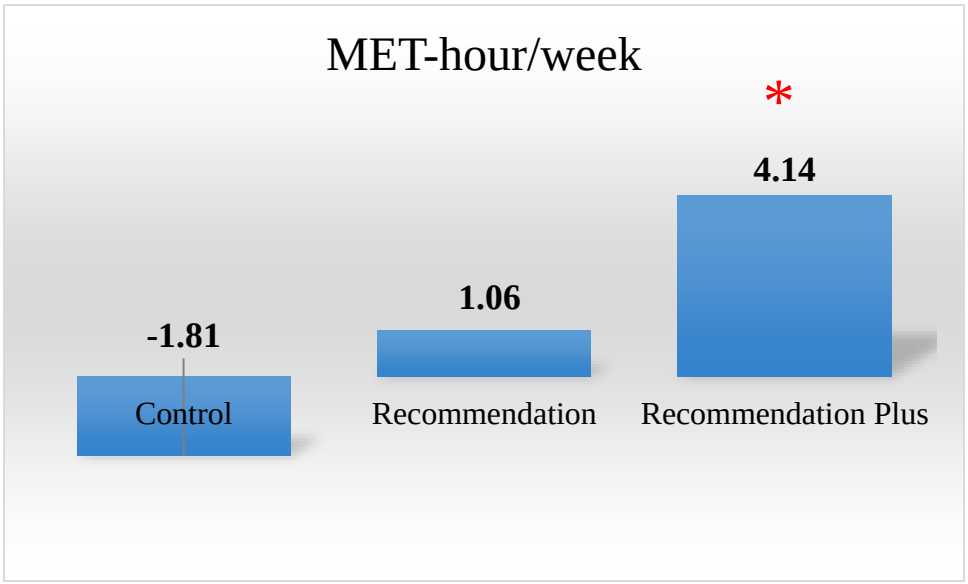
[b] Significantly different from the control group.

[c] Significantly different from the oncologist's exercise recommendation group ($P<.05$).


Mild intensity exercise (min)
Control
-58.21
Recommendation
-23.42
*
9.42
Recommendation Plus


Moderate intensity exercise (min)
10.34
Control
16.79
Recommendation
*
40.22
Recommendation Plus


Total exercise (min)
-39
Control
0.99
Recommendation
*
47.57
Recommendation Plus


MET-hour/week
-1.81
Control
1.06
Recommendation
*
4.14
Recommendation Plus

VOLUME 25 · NUMBER 17 · JUNE 10 2007

JOURNAL OF CLINICAL ONCOLOGY

ORIGINAL REPORT

Randomized Controlled Trial of the Effects of Print Materials and Step Pedometers on Physical Activity and Quality of Life in Breast Cancer Survivors

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Submitted June 26, 2006; accepted January 17, 2007.

Supported by a research team grant from the National Cancer Institute of Canada (NCIC) with funds from the Canadian Cancer Society (CCS) and the CCS/NCIC Sociobehavioral Cancer Research Network. At the time of this study, J.K.H.V. was supported by a Canada Graduate Scholarship from the Canadian Institutes of Health Research (CIHR) and a Doctoral Incentive Award from the Alberta Heritage Foundation for Medical Research (AHFMR). K.S.C. is supported by the Canada Research Chairs Program. R.C.P. is supported by Salary Awards from CIHR and AHFMR. Y.Y. is supported by the Canada Research Chairs Program and a Salary Award from AHFMR.

Authors' disclosures of potential conflicts of interest and author contributions are found at the end of this article.

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ABSTRACT

Purpose
To determine the effects of breast cancer–specific print materials and step pedometers on physical activity (PA) and quality of life (QoL) in breast cancer survivors.

Patients and Methods
Breast cancer survivors (N = 377) were randomly assigned to receive one of the following: a standard public health recommendation for PA, previously developed breast cancer–specific PA print materials, a step pedometer, or a combination of breast cancer–specific print materials and step pedometers. The primary outcome was self-reported moderate/vigorous PA minutes per week. Secondary outcomes were QoL (Functional Assessment of Cancer Therapy–Breast), fatigue, self-reported brisk walking, and objective step counts. Assessments were conducted at baseline and postintervention (12 weeks).

Results
Attrition was 10.3% (39 of 377). On the basis of linear mixed-model analyses, PA increased by 30 minutes/week in the standard recommendation group compared with 70 minutes/week in the print material group (mean difference, 39 minutes/week; 95% CI = −10 to 89; $d = 0.25$; $P = .117$), 89 minutes/week in the pedometer group (mean difference, 59 minutes/week; 95% CI, 11 to 108; $d = 0.38$; $P = .017$), and 87 minutes/week in the combined group (mean difference, 57 minutes/week; 95% CI, 8 to 106; $d = 0.37$; $P = .022$). For brisk walking minutes/week, all three intervention groups reported significantly greater increases than the standard recommendation group. The combined group also reported significantly improved QoL (mean difference, 5.8; 95% CI, 2.0 to 9.6; $d = 0.33$; $P = .003$) and reduced fatigue (mean difference, 2.3; 95% CI, 0.0 to 4.7; $d = 0.25$; $P = .052$) compared with the standard recommendation group.

Conclusion
Breast cancer–specific PA print materials and pedometers may be effective strategies for increasing PA and QoL in breast cancer survivors. A combined approach appears to be optimal.

Clinical Trial Registration
ClinicalTrials.gov Identifier NCT00221221

J Clin Oncol 25:2352-2359. © 2007 by American Society of Clinical Oncology

Table 2. Effects of PM and PED on PA and Walking Behavior in Breast Cancer Survivors (N = 377)

Variable	Baseline*		Postintervention†		Mean Change‡		Between-Group Comparison		
	Mean	SD	Mean	SD	Mean	95% CI	Mean	95% CI	*P*
Self-reported moderate/vigorous PA, minutes/week									
SR (n = 96)	133	144	163	121	+30	−4 to 65	COM *v* SR: +57	8 to 106	.022
PM (n = 94)	126	159	197	160	+70	34 to 105	PED *v* SR: +59	11 to 108	.017
PED (n = 94)	123	154	214	178	+89	55 to 123	PM *v* SR: +39	−10 to 89	.117
COM (n = 93)	119	163	211	169	+87	53 to 123	COM *v* PED:−2	−63 to 67	.947
							COM *v* PM: +21	−45 to 87	.532
Self-reported brisk walking, minutes/week									
SR (n = 96)	101	143	102	105	+0	−36 to 36	COM *v* SR: +58	6 to 109	.028
PM (n = 94)	77	121	153	206	+72	35 to 108	PED *v* SR: +94	43 to 144	.000
PED (n = 94)	69	118	162	221	+93	57 to 129	PM *v* SR: +72	20 to 123	.006
COM (n = 93)	64	105	121	146	+58	21 to 94	COM *v* PED: −36	−98 to 27	.260
							COM *v* PM: −18	−81 to 45	.576
7-day pedometer step count									
SR (n = 96)	7,938	3,905	8,028	3,457	+91	−1,021 to 1,203	COM *v* SR: −301	−1,887 to 1,304	.710
PM (n = 94)	8,306	3,831	8,114	3,778	−191	−1,323 to 941	PED *v* SR: −146	−1,718 to 1,425	.885
PED (n = 94)	8,476	3,248	8,420	5,226	−55	−1,166 to 1,055	PM *v* SR: −282	−1,870 to 1,304	.727
COM (n = 93)	7,993	3,559	7,783	3,048	−210	−1,341 to 921	COM *v* PED: −155	−1,740 to 1,430	.848
							COM *v* PM: −19	−1,619 to 1,581	.982

Abbreviations: PM, print material; PED, step pedometer; PA, physical activity; SD, standard deviation; SR, standard recommendation; COM, PM and PED combined.
*Data based on all study participants (N = 377).
†Data based on participants who completed the trial (n = 338).
‡Mean change scores based on mixed-model analysis; may not precisely reflect postintervention minus baseline scores given that means are mode fitted.

Printed material, pedometer or printed material+pedometer effective in increasing PA vs. standard recommendation only.

How can we support oncologist to recommend PA to their patients?

What else can we (Oncologist + Exercise specialist) do to promote PA among cancer survivors?

Oncologist

- Encourage cancer survivors to increase PA
- Develop system within the hospital to provide exercise counselling and education
- Refer cancer patients to exercise specialist if necessary

Exercise specialist

- Teach exercise and provide exercise counselling to cancer survivors (Cancer related and unrelated)
- Provide cancer survivors materials developed together with oncologist
- Develop evidence that exercise is beneficial for cancer survivors

- Develop evidence-based exercise program for cancer survivors based on cancer survivors characteristics
- Develop exercise guideline for cancer survivors

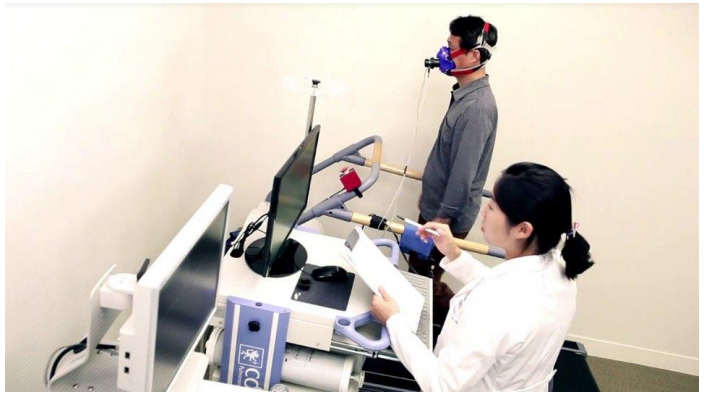

Colorectal cancer survivors
Breast cancer survivors
Stomach cancer survivors
Children with cancers
Patients with hematopoietic stem cell transplantation
Prostate cancer survivors
Before surgery
During recovery from surgery
During chemotherapy
During hematopoietic stem cell transplantation
After completion of cancer therapy

With the Love of God

Free Humankind from Disease and Suffering

Surgeons, oncologists, public health, nurses, exercise specialists

Cancer Prevention Center, Yonsei Cancer Center




1_08_어깨 스트레칭 (십자)
1_09_뒤로 깍지 끼기
1_10_어깨 스트레칭
1_17_에어 스쿼트
1_18_밸런스 토터치
1_19_숄더 프레스
1_26_목 버티기기
1_27_누워서 어깨 스트레칭
1_28_누워서 어깨 운동
1_35_레그 레이즈
1_36_리버스 크런치
1_37_크런치
1_44_고양이자세
1_45_플랭크운동
1_46_허리밸런스 운동
1_38_자전거복부
1_39_누워서 고관절 운동
1_40_누워서 허벅지 운동
1_48_슈퍼맨엑설사이즈
1_49_푸쉬업
1_50_포인터 운동
2_01_굿모닝 엑설사이즈
2_02_니 업
2_03_팔벌려높이뛰기
2_10_런지
2_11_사이드레터럴 런지
2_12_허벅지운동
2_19_손가락벽타기
2_20_골반기울이기
2_21_숄더브릿지


Smoking, Alcohol control, other lifestyle
Nutritional intervention
Hiking, Walking, Swimming, Running etc.
Using exercise equipment
Shoulder
Stomach Cancer
Knee
Prostate Cancer
Eight Exercise
Breast Cancer
Hip joint
Colorectal Cancer
Incontinence

Our Research Team
(Cancer Prevention Center)

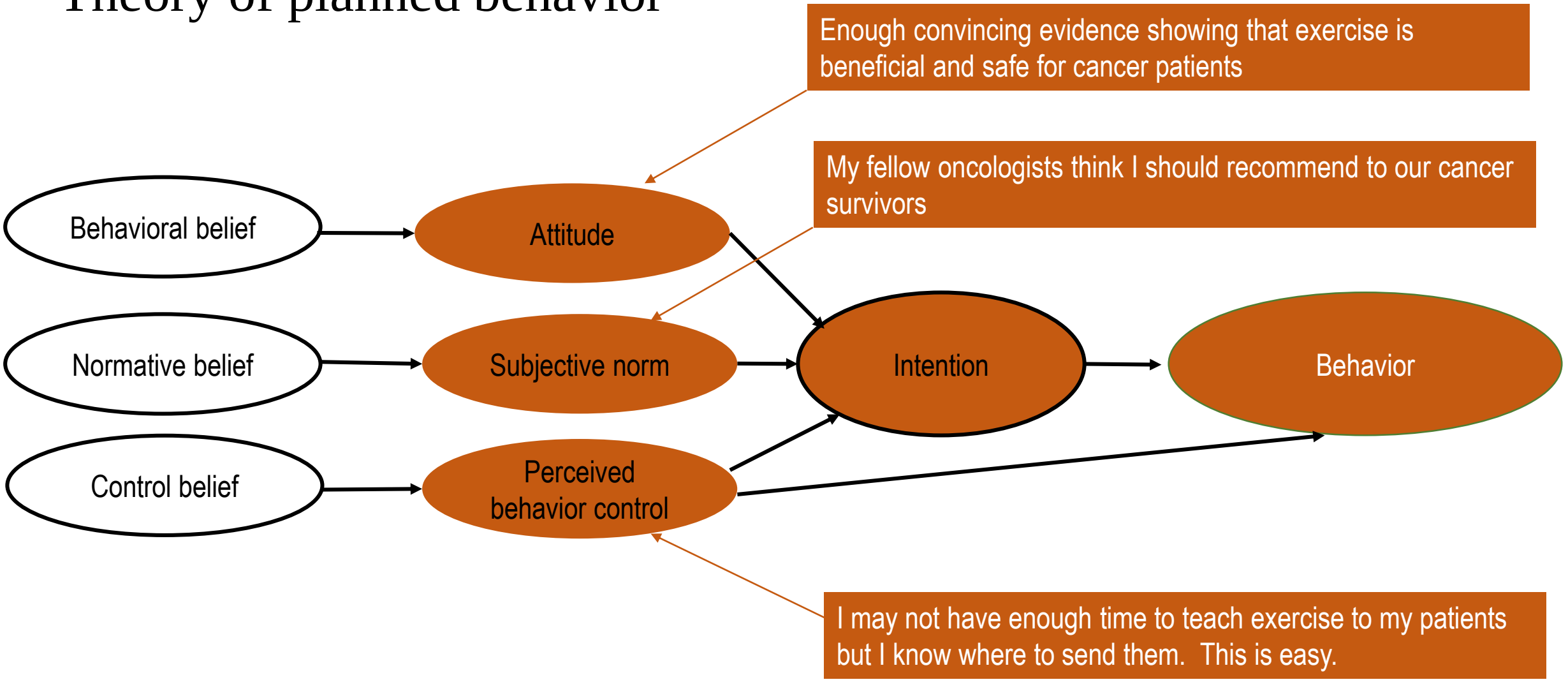
Between year 2014. 04-2018.03

We provided exercise counseling and education to total 2,302 cancer survivors

Special Thanks to Jihye Park, Ph.D

Dr. Seung Il Kim, Yonsei Cancer Center (Breast Cancer Surgeon)
Dr. Nam Kyu Kim, Yonsei Cancer Center (Colorectal Cancer Surgeon)

Theory of planned behavior



Helping oncologists to change their PA recommendation behavior