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Knowledge and exercise behavior maintenance in cardiac rehabilitation patients receiving educational interventions

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Funding:

This work was supported by the Heart & Stroke/Richard Lewar Centre of Excellence Fellowship Award.

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Abstract

Objectives: To test whether a theoretically-based education curriculum results in more sustained knowledge, higher scores on Health Action Process Approach (HAPA) constructs, and greater exercise behavior 6 months post-cardiac rehabilitation (CR) when compared to traditional CR education.

Background: Patient education is a core component of CR. No research has examined whether this education results in sustained improvements post-program.

Methods: In this quasi-experimental study, participants exposed to the traditional vs HAPA-based education completed surveys pre, post-CR, and 6 months post-discharge assessing knowledge, HAPA constructs, and exercise.

Results: Ninety-three participants completed the final survey. Knowledge increases post-CR were sustained 6 months post-program, with no differences by curriculum. Many improvements in HAPA constructs observed post-CR were sustained, except for some decay in self-efficacy. Minutes of exercise per week were significantly greater in participants exposed to the HAPA-based curriculum 6 months post-program.

Conclusions: HAPA-based education in CR has sustained effects on exercise.

Keywords: Patient education; health behavior theory; knowledge; physical exercise; cardiovascular disease.

Abbreviations list

Cardiovascular diseases: CVDs

Coronary Artery Education Questionnaire: CADE-Q

Cardiac rehabilitation: CR

Health Action Process Approach: HAPA

Medical Term Recognition Test: METER

The Newest Vital Sign: NVS

Introduction

Cardiac rehabilitation (CR) - a comprehensive outpatient program of secondary prevention and lifestyle counselling[1] - is the standard of care for outpatients with cardiovascular diseases (CVDs).[2-4] The core components of CR, commonly agreed-upon by the major CR societies internationally,[5-8] include patient assessment, lifestyle and medical risk factor management, psychosocial management, and patient education to achieve health behavior change and hence long-term control and secondary prevention of CVDs.

Patient education is one of the least studied components of CR, but arguably it is one of the most important. Education can be formally defined as "the process by which health professionals and others impart information to patients that will alter their health behaviors or improve their health status".[9] Findings from meta-analyses have demonstrated that patient education in CVD patients results in better self-management behaviors,[10-12] and health-related quality of life, while potentially reducing healthcare costs[13] and recurrence of acute events.[12] Moreover, a recent systematic review also demonstrated the benefits of educational interventions in CVD patients, with regard to their knowledge and behavior change.[14] There has been scant research on education in the CR setting specifically.

Our group has empirically investigated CR participant information needs,[15] and used this information along with theory, to develop an evidence-based CR education curriculum.[16] Some theoretical orientations considered included adult learning principles[17], constructivist learning theory[18], and self-management theory.[19] The theoretical basis of the curriculum is the Health Action Process Approach (HAPA) - a

psychological theory of health behavior change -,[20] as it focuses on the elements required to change behavior in a sustained manner. According to the HAPA model, changing health-related behaviors requires two separate processes, involving motivation and volition, respectively. First, the motivational phase is the process in which an individual forms an intention to either adopt a precautionary action or change risk behaviors in favor of others, in part on the basis of self-beliefs. Second, in the volition phase, change must be planned, initiated, and maintained, and relapses must be managed. In addition, self-regulation plays a critical role in these processes.[21] A recent overview covering seven empirical studies[22] has demonstrated the applicability of the HAPA for a number of health behaviors and for diverse samples from various cultures, including exercise adherence after CR.[23]

We previously reported our initial evaluation of this curriculum.[24] Exposure to the HAPA-based curriculum did not result in greater knowledge post-CR when compared to participation in traditional CR education. However, we hypothesized that this new curriculum would have more sustained effects on knowledge and behavior post-program than traditional education. Accordingly, the objectives of this study were to test whether patient participation in a theoretically and empirically-based CR education curriculum results in more: (1) knowledge and greater endorsement of HAPA-constructs, and (2) exercise behavior 6 months post-CR when compared to traditional education.

Methods

Participants

Participants included CR enrollees (with CVD or multiple cardiovascular risk factors) recruited from the largest CR program in Toronto, Canada. The exclusion criteria

were: lack of English-language proficiency, and any visual, cognitive or psychiatric condition that would preclude the participant from completing the surveys.

As reported elsewhere,[24] 306 patients consented to participate in this evaluation, of which 146 (47.7%) were exposed to the HAPA-based curriculum. One hundred and seventy-three (56.6%) completed the post-CR survey. This paper includes these participants that also completed the 6-month post-CR survey. The sample size calculations for the primary study were based on the rule of thumb of a minimum of 100 participants to run structural equation modeling and anticipating a retention rate of 70% (so a minimum of 145 participants per group were required).[25] Patients were approached consecutively until the required sample size was achieved.

Design and Procedure

Ethics approval was obtained from the review board at the hospital where the CR program was located. Patients were informed about the study during their first cardiopulmonary exercise stress test by a technician. Consenting patients were then invited to complete a self-administered confidential survey in paper format (pre-CR survey). Clinical data were extracted from patient charts using a standardized Case Report Form. Data collection for this quasi-experimental longitudinal study was conducted between April 2013 and December 2014. Allocation of patients to educational curriculum was based on their choice of class time.

CR participants are offered weekly-supervised exercise classes for 24 weeks (i.e. 6 months), and provided a home exercise prescription for the other days of the week. Between the 22nd and 24th weeks of CR, patients were approached during their CR class to complete the post-CR survey. Finally, 6 months after graduation patients were

contacted by phone and a third and final survey (6-month post-CR survey) was mailed to them. This study presents findings from the final assessment 6 months post-CR. Findings from the pre and post-CR assessment are reported elsewhere.[24]

Education Curricula

The traditional education curriculum focused on educating patients and the HAPA-based education curriculum was based on promoting behavior change, aiming to enable patients to take charge of their medical condition and respond appropriately to changes in their health, developing strategies to improve their risk factors. Topics covered in both curricula were similar, but the ones from the HAPA-based education curriculum were strategically sequenced in accordance with the CR program learning outcomes (Table 1). For both groups, education was delivered in large and small group sessions, lectures, a workbook, and online videos; however, topics for the HAPA-based education curriculum contained learning activities, learning assessments, behavioral-based action planning, and assessment of patients' motivation and confidence to incorporate change into their lifestyle. Both education curricula were provided by an interdisciplinary team of on-site exercise leaders, nurses, dietitians, a psychologist, and physicians.[16,24]

Measures

Clinical characteristics extracted from CR charts included CR referral indication and cardiac risk factors. The initial pre-CR survey assessed sociodemographic characteristics and included 2 health literacy scales, namely the medical term recognition test (METER)[26] and the newest vital sign (NVS).[27] METER is a brief and practical measure of health literacy for use in clinical settings. It consists of a list of health-items

and patients are simply asked to check off those they recognize as actual words.[26] The NVS tests literacy skills for both numbers and words. Respondents are presented with a food label and asked to respond to 6 questions.[27]

All 3 surveys included scales to assess patients' CVD knowledge, HAPA constructs, and exercise behavior. Knowledge was assessed via the Coronary Artery Disease Education Questionnaire-II (CADE-Q II), which assesses patients' knowledge about CAD in 5 domains: medical condition, risk factors, exercise, nutrition, and psychosocial risk. Each of the 31 items has 4 alternative response options, of which one is most correct (scored 3), one is somewhat accurate (scored 1), and two are incorrect (scored 0). These scores are summed, with a maximum score of 93.[28] The CADE-Q II was demonstrated to have good reliability and validity, with a Cronbach's alpha of 0.91, criterion validity supported by significant differences in mean scores by educational level ($p<.001$), and factor analysis with four factors, which were all internally-consistent (0.65-0.77) and well-defined by items.[28]

All constructs from the HAPA model were assessed via psychometrically-validated scales, namely risk awareness,[29] outcome expectancies,[22] intention,[22] action planning,[23] coping planning,[22] and three types of self-efficacy (task, scheduling, and maintenance).[29] Each one of these constructs and their associated scales are described in detail elsewhere.[24]

The target behavior was exercise, which was self-reported. The 2 questions were: "How often do you usually walk in a week?" (never, less than 3-4 times, more than 3-4), and "How much time do you spend exercising per week? (in hours)". Canadian guidelines recommend at least 30 minutes of moderate to vigorous physical activity on

most, preferably, all days of the week for patients with coronary artery disease. This is equivalent to 3.5 hours per week.[7]

Statistical analysis

SPSS Version 21.0 was used. First, the sociodemographic and clinical characteristics of patients overall and by educational curriculum at the final assessment were described and compared by t-test or chi-square as applicable.

To test the first objective, mean CADE-Q II scores were examined by item, subscale and overall at the final assessment point. Paired t-tests, repeated measures analysis of variance (ANOVA), and LSD post-hoc tests were computed to investigate changes and differences in knowledge by education curricula and timepoint, respectively. A similar approach was taken towards the HAPA constructs and exercise behavior. To test the second objective, a regression model was computed with hours of weekly exercise as the dependent variable, and curriculum, as well as knowledge and HAPA construct scores at 6 months post-CR as independent variables.

Results

Respondent Characteristics

Ninety-three participants (30.4% retention) completed the final assessment 6 months after CR discharge, of which 43 (46.2%) participants were exposed to the HAPA-based curriculum. All of these participants completed the CR program, and hence would have been exposed to the majority of the education sessions. Pre-CR sociodemographic and clinical characteristics of the sample overall and by education curriculum are shown elsewhere.[24] This was a highly-educated sample (74.2% of participants had a college or university diploma), and participants had functional, and adequate health literacy as

demonstrated by high mean scores on the METER and NVS, respectively. There were no significant differences in participant characteristics, knowledge, HAPA constructs or exercise pre or post-CR by curriculum.[24]

Sociodemographic and clinical characteristics of participants included in this study are shown in Table 2. Overall, significantly more males (75.3%) participated in this study than females (24.7%). Retained participants in the HAPA-based education curriculum had significantly more myocardial infarction and underwent more percutaneous coronary intervention than patients exposed to the traditional education curriculum (p=0.04). No other differences were observed. No differences were found between retained and lost to follow-up samples.

Knowledge

Table 3 displays overall knowledge and subscale scores in the retained sample by assessment point. There was a significant increase ($p<.01$) in overall knowledge from pre-CR to post-CR and from pre-CR to 6 months post-CR in the overall sample, as well as in participants exposed to both curricula. There were no knowledge differences between CR completion and 6 months later. The increase in knowledge from pre to post-CR and from pre-CR to 6 months post-discharge was also observed on all knowledge subscales in the overall sample. This indicates that participants increased their knowledge about CVD during CR and maintained these gains 6 months after discharge.

With regard to knowledge 6 months post-program, participants exposed to the HAPA-based curricula had significantly greater knowledge than they did pre-program on 4 of the 5 subscales (all but risk factors); participants exposed to the traditional curricula only had significantly greater knowledge on 2 subscales – exercise and nutrition (Table

3). As also shown, there were no significant knowledge differences by curricula overall, on any subscales, at any time point.

Changes in HAPA constructs

We next tested whether exposure to the new curriculum did have an impact on HAPA constructs in the long-term as intended. Table 4 displays mean HAPA construct scores at each assessment point, overall in the retained sample and by curriculum. Overall, there was a significant improvement ($p<.05$) from pre-CR to 6-months post-CR in the following constructs: risk awareness, outcome expectancies, as well as action and coping planning; there was a significant reduction in task and scheduling self-efficacy from post-program to 6 month later.

As also shown in Table 4, from pre-CR to 6 months post-program, participants exposed to the traditional education curriculum realized improvements in risk awareness and action planning; participants exposed to the HAPA-based curriculum realized significant improvements in risk awareness, psychological and physical outcome expectancies, and action planning. No differences were observed in either curriculum from post-program to 6 months later.

Finally, as also shown in Table 4, there were some significant differences in HAPA constructs by curriculum. Participants exposed to the HAPA curriculum had significantly greater social outcome expectancies post-program, and greater scheduling self-efficacy 6 months post-program than participants exposed to the traditional curriculum.

Exercise Behavior

Exercise behavior by assessment point and curriculum is described in Table 4 and illustrated in Figure 1. As shown, overall participants reported engaging in significantly more hours of exercise both post-CR and 6 months post-program than they did pre-CR. By curriculum, these significant increases were reported by participants exposed to the traditional curriculum from pre to post-CR only, and by participants exposed to the HAPA-based curriculum from pre-CR to 6 months post-CR only.

Significant differences in exercise between curricula were observed only 6 months after discharge, where participants exposed to the HAPA-based curriculum reported significantly more hours of exercise per week compared to participants exposed to the traditional curriculum (Figure 1). No differences were found at the frequency of walking per week variable, overall or by groups.

Results of the regression model of the role of education curriculum exposure, knowledge and HAPA constructs in exercise 6 months post-program is shown in Table 5. As displayed, the only variable that emerged as a significant predictor of hours of weekly exercise was type of curriculum ($p<.05$).

Discussion

The present study provides evidence that education interventions in CR are effective strategies to sustainably improve knowledge, affect theoretical constructs integral to behavior change and enhance physical exercise. Despite the fact that the sample was highly educated and health-literate, there was a significant increase in patients' CVD-related knowledge from pre-CR through 6 months after CR discharge, which did not decay post-program. Many improvements in HAPA constructs observed

post-CR were sustained, including the following: risk awareness, outcome expectancy (psychological and physical), task self-efficacy and action and coping planning.

In regards to behavior, overall patients increased their hours of exercise per week from pre- to post-CR and maintained this 6 months after discharge. This is an important finding considering long-term maintenance of exercise behavior remains a challenge after CR. Previous research has shown that only 38-56% of CR participants are adequately active 1 year after CR program completion.[30,31] Of note, participant exposure to the HAPA-based curriculum in particular was associated with greater exercise 6 months post-program. This is particularly encouraging given the cardiometabolic effects of exercise are related to reduced mortality in CVD patients.[32] Surprisingly in this study, patients greatly exceeded the guideline recommendations for physical activity[7]. This could be explained based on the nature of the cohort (i.e., highly educated and health literate patients are more likely to exercise)[33,34] or due to the fact that exercise behavior was self-reported, which can lead social desirability bias and over-reporting.

In regards to HAPA constructs, many improvements observed post-CR were sustained, except for some decay in self-efficacy. Participants exposed to the HAPA-based curriculum had significantly greater scheduling self-efficacy than those exposed to the traditional curriculum. Scheduling self-efficacy relates to managing one's schedule to accommodate the behavior and can directly influence planning,[35] which refers to concrete plans about when, where, and how to implement an intended behavior.[36] Intention – the most proximal and powerful predictor of subsequent behavior[37-39] – was sustained 6 months post-CR. Although good intentions do not necessarily guarantee corresponding

actions and is seldom successful alone[40], according to the HAPA model,[20] intention is correlated with planning, which may lead to behavior change.

Caution is warranted when interpreting these results. The chief limitation is related to study design. A study with a randomized design and control group of CR patients not receiving education is warranted, to ascertain whether the increases in knowledge and subsequently exercise identified herein are robust. Causal conclusions cannot be drawn based on the design applied herein. Second, the study is limited by potential selection bias. It is unknown how this convenience sample compares to the broader population of CR patients. However, some evidence suggests that late responders (following repeated attempts) may not be very different on key health variables compared to responders, suggesting bias may not highly impact the findings herein.[41] Third, generalizability is limited. The results are specific to a small, well-educated sample of cardiac patients who attended a comprehensive CR program at a single academic center. Also, exercise behavior tends to be more common among the highly educated, as previously described. Generalizability is also limited due to the low retention rate, although no retention bias was found when sociodemographic and clinical characteristics were compared between those retained and those lost to follow-up. We did not report the number of patients approached to get consent. Fourth, CR program adherence was not recorded, and although all participants completed the program, we cannot confirm how many education sessions participants may have missed. Fifth, exercise behavior was self-reported using non-validated questions, which can introduce social desirability bias and over-reporting. The use of objective assessment tools such as accelerometers should be undertaken, or at the least a psychometrically-validated self-report scale. Future

replication in a larger cohort of cardiac patients with a broad representation of educational attainment, using a randomized, controlled design is needed to confirm results obtained in the present study.

Conclusions

Knowledge increases achieved in CR are sustained 6 months post-program, and do not decay. Although improved knowledge was observed with exposure to either education curricula, knowledge was greater across subscales in participants exposed to the HAPA-based curricula, and there were greater improvements in HAPA constructs 6 months post-program. Most importantly, exercise was significantly greater in patients exposed to the HAPA-based curriculum 6 months post-program when compared to patients who participated in traditional CR education.

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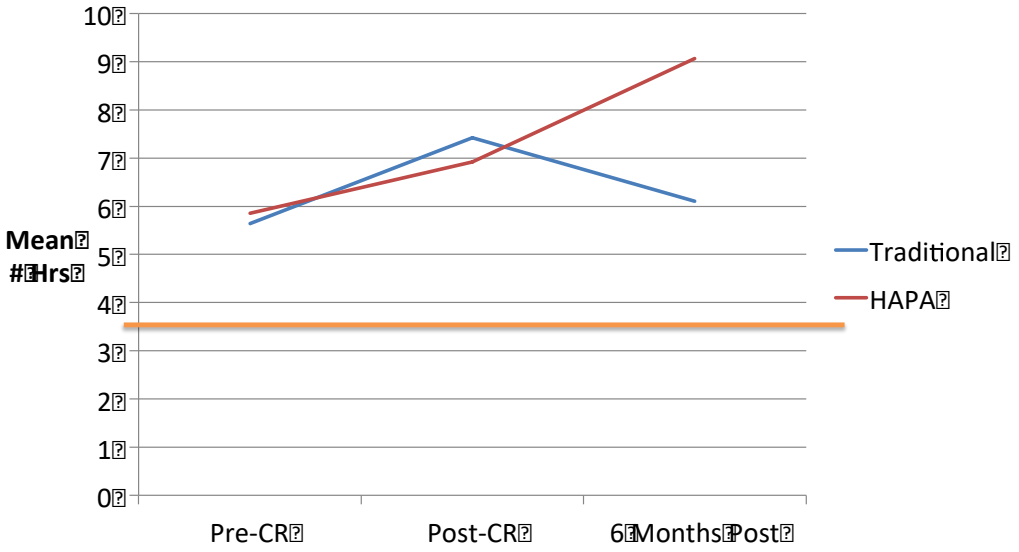
Figure 1: Exercise behavior by assessment point and curriculum



Tables

Table 1 – Program Learning Outcomes for HAPA-based educational Curriculum

By the end of their 6-month CR program, patients will be able to:
1. Take charge of their medical condition and respond appropriately to changes in their health status;
2. Maintain an exercise program to improve their health and well-being;
3. Identify and develop strategies to improve their risk factors for heart disease;
4. Incorporate healthy food choices and practices to manage their health and well-being; and,
5. Identify and develop strategies to manage their psychosocial risks for heart disease and improve their well-being.

CR indicates Cardiac Rehabilitation

Table 2 – Sociodemographic and Clinical Characteristics of Participants Retained 6 Months Post-CR, and by Educational Curriculum.

Characteristic	Retained (N=93)	Education Curriculum		
		Traditional (n=50; 53.8%)	HAPA-based (n=43; 46.2%)	p*
Sociodemographic				
Age, years (mean±SD)	67.39±11.06	67.42±10.62	67.35±11.67	0.98
Sex, n (%)				0.20
Female	23 (24.7%)	15 (30.0%)	8 (18.6%)	
Male	70 (75.3%)	35 (70.0%)	35 (81.4%)	
Highest Educational Attainment, n (%)§				0.60
Less than high school	8 (8.6%)	6 (12.0%)	2 (4.7%)	
High School	12 (12.9%)	6 (12.0%)	6 (14.0%)	
Trades Certificate	3 (3.2%)	1 (2.0%)	2 (4.7%)	
College	21 (22.6%)	10 (20.0%)	11 (25.6%)	
University	48 (51.6%)	26 (52.0%)	22 (51.2%)	
Health Literacy, (mean±SD)†				
METER	36.04±4.55	36.12±4.70	35.95±4.43	0.86
NVS	4.75±1.51	4.62±1.45	4.90±1.57	0.37
Clinical, n (% yes)‡				
Referral Indication				
Heart Failure	8 (8.6%)	3 (6.0%)	5 (11.6%)	0.35
Cardiomyopathy	3 (3.2%)	2 (4.0%)	1 (2.3%)	0.65
Stroke/Transient Ischemic Attack	3 (3.2%)	2 (4.0%)	1 (2.3%)	0.65
Valvular Heart Disease	15 (16.1%)	10 (20.0%)	5 (11.6%)	0.27
Peripheral Vascular Disease	3 (3.2%)	2 (4.0%)	1 (2.3%)	0.65
Chronic Obstructive Pulmonary Disease	6 (6.5%)	3 (6.0%)	3 (7.0%)	0.85
Angina	2 (2.2%)	1 (2.0%)	1 (2.3%)	0.92
Fibrillation	11 (11.8%)	6 (12.0%)	5 (11.6%)	0.96
Myocardial Infarction	29 (31.2%)	11 (22.0%)	18 (41.9%)	**0.04**
Coronary Artery Bypass Graft Surgery	22 (23.7%)	14 (28.0%)	8 (18.6%)	0.29
Percutaneous Coronary Intervention	33 (35.5%)	13 (26.0%)	20 (46.5%)	**0.04**
Risk factors				
Hypertension	41 (44.1%)	22 (44.0%)	19 (44.2%)	0.99
Type I Diabetes	5 (5.4%)	2 (4.0%)	3 (7.0%)	0.25
Type II Diabetes	10 (10.8%)	5 (10.0%)	5 (11.6%)	0.80
Depression	3 (3.2%)	2 (4.0%)	1 (2.3%)	0.65

Sleep Apnea	9 (9.7%)	6 (12.0%)	3 (7.0%)	0.41
Smoking history	31 (33.3%)	16 (32.0%)	15 (34.9%)	0.77
Smoking, years (mean±SD)	7.46±13.53	7.50±14.22	7.40±12.86	0.97

SD indicates standard deviation, HAPA Health Action Process Approach, METER Medical Term Recognition Test (maximum score = 40), NVS Newest Vital Sign (maximum score = 5).
*Chi-square or t-tests as appropriate for differences between curricula ($p<.05$ for significant differences between traditional and new educational curriculum, if any).
§Self-reported.
†Assessed via pre-CR survey.
‡Extracted from patient records.

Table 3 – Total and subscale knowledge scores at pre-CR, post-CR and 6-months after post-CR in overall retained sample, and by curriculum

Knowledge scores maximum possible score), mean±SD	**Overall (N=93)**			**Traditional (n=50; 53.8%)**			**HAPA-based (n=43; 46.2%)**			
	Pre-CR	Post-CR	6 months post-CR	Pre-CR	Post-CR	6 months post-CR	Pre-CR	Post-CR	6 months post-CR	p†
Total Knowledge (93)	67.24±14.75	76.58±10.05 §***	75.29±14.34 §§§***	65.30±16.08	76.20±10.94 §***	73.84±15.25 §§§***	69.49±12.86	77.02±9.00 §***	76.98±13.18 §§§**	0.17;0.70; 0.30
Subscales										
Medical Condition (21)	15.69±4.37	17.26±3.53 §***	17.23±4.49 §§§**	15.50±4.84	17.38±3.63 §**	16.72±4.86	15.91±3.80	17.12±3.45 §**	17.81±3.99 §§§**	0.67;0.72; 0.24
Risk Factors (15)	9.97±3.03	11.42±2.22 §***	10.77±3.21 §§§**	9.78±3.10	11.30±2.50 §**	10.74±3.65	10.19±2.96	11.56±1.87 §**	10.81±2.65	0.52;0.38; 0.91
Exercise (21)	16.23±4.57	18.82±2.39 §***	18.27±4.13 §§§***	15.30±4.85	18.54±2.56 §***	17.88±4.17 §§§***	17.30±4.01	19.14±2.16 §**	18.72±4.07 §§§**	0.05;0.23; 0.33
Nutrition (21)	15.08±4.05	17.17±2.95 §***	17.52±2.91 §§§***	14.68±4.38	17.16±2.87 §***	17.30±3.03 §§§***	15.53±3.63	17.19±3.08 §**	17.77±2.79 §§§***	0.31;0.96; 0.44
Psychosocial Risk (15)	10.28±3.63	11.91±2.49 §***	11.51±3.07 §§§**	10.04±3.65	11.82±2.50 §**	11.20±2.98	10.56±3.63	12.02±2.51 §**	11.86±3.17 §§§**	0.50;0.70; 0.30

SD indicates standard deviation; HAPA indicates Health Action Process Approach.

Significant differences (ANOVA): *p<.05; **p<.01; ***p<.001

Time comparisons within the same curricula: §between pre and Post-CR; §§between Post-CR and 6-months post-discharge; §§§between baseline and 6-months post-discharge (paired t-tests).

†ANOVA (independent variable=curricula) at pre-CR; post-CR; and 6 months post-CR

Table 4 – HAPA constructs and exercise behavior at pre-CR, post-CR and 6-months post-CR in overall retained sample, and by curriculum

	Overall (n=93)			**Traditional (n=50; 53.8%)**			**HAPA-based (n=43; 46.2%)**			
	Pre-CR	Post-CR	6 months post-CR	Pre-CR	Post-CR	6 months post-CR	Pre-CR	Post-CR	6 months post-CR	p†
Constructs (mean±SD)										
Risk Awareness	5.16±1.54	5.69±1.19 §***	5.73±1.05 §§§**	5.17±1.73	5.61±1.32	5.72±1.00 §§§*	5.15±1.30	5.79±1.04 §***	5.75±1.12 §§§**	0.94;0.47;0.88
Outcome Expectancies										
Social	4.31±1.62	4.62±1.46	4.71±1.35 §§§**	4.21±1.81	4.17±1.58	4.58±1.31	4.43±1.38	5.16±1.09 §**	4.87±1.39	0.51;**0.001**;0.29
Psychological	5.67±1.55	6.10±1.04 §*	6.23±0.83 §§§*	5.65±1.72	6.01±1.29 §*	6.26±0.92	5.70±1.35	6.20±1.04 §*	6.20±0.73 §§§*	0.87;0.40;0.69
Physical	5.01±1.52	5.73±2.12 §**	5.63±1.13 §§§***	5.09±1.75	5.35±1.38	5.50±1.26	4.91±1.22	6.17±2.69 §**	5.77±0.94 §§§**	0.58;0.06;0.26
Self-efficacy										
Task	5.30±1.86	5.93±1.31 §**	5.47±1.71 §§**	5.21±1.93	5.86±1.44 §*	5.39±1.79	5.41±1.78	6.01±1.14 §*	5.57±1.63	0.61;0.58;0.62
Scheduling	5.32±1.76	5.56±1.64	4.97±1.94 §§***	5.04±1.84	5.48±1.74	4.52±2.11	5.63±1.63	5.65±1.52	5.49±1.58	0.10;0.62;**0.02**
Maintenance	5.33±1.39	5.44±1.32	5.38±1.72	5.07±1.61	5.22±1.29	5.14±1.97	5.63±1.01	5.69±1.31	5.66±1.34	0.05;0.08;0.15
Intention	6.42±1.23	6.37±1.05	6.17±1.18	6.30±1.46	6.28±1.11	6.09±1.37	6.55±0.89	6.47±0.97	6.26±0.92	0.32;0.40;0.50

Planning										
Action	5.05±1.66	6.12±0.72 §***	5.83±1.40 §§§***	4.62±1.82	5.99±0.80 §***	5.61±1.68 §§§***	5.55±1.29	6.28±0.60 §**	6.09±0.92 §§§*	**0.006**;0.05;0.10
Coping	4.42±1.69	5.07±1.40 §***	4.86±1.68 §§§**	4.19±1.88	4.91±1.60 §**	4.65±1.80	4.69±1.41	5.26±1.12 §*	5.11±1.51	0.16;0.23;0.18
Behavior										
Weekly physical exercise, hours (mean±SD)	5.74±6.00	7.19±5.54 §*	7.54±5.96 §§§*	5.64±6.61	7.42±6.36 §*	6.11±4.65	5.85±5.32	6.92±4.49	9.07±6.84 §§§**	0.87;0.68;**0.02**
Walking 3-4 times per week or more, n (%)	91 (97.8%)	93 (100.0%)	93 (100.0%)	48 (96.0%)	50 (100.0%)	50 (100.0%)	43 (100.0%)	43(100.0%)	43 (100.0%)	0.71;0.96;0.96

SD indicates standard deviation; HAPA indicates Health Action Process Approach.
Note: Maximum score possible = 7
Significant differences (ANOVA): *p<.05; **p<.01; ***p<.001
Comparisons within the same group by time: §between Pre-CR and Post-CR; §§between Post-CR and 6-months post-CR; §§§between pre-CR and 6-month post-CR (paired t-tests).
† ANOVA (between groups) at pre-CR; post-CR; 6 months post CR.

Table 5: Summary of Simple Regression Analyses for Variables Associated with hours of weekly exercise (dependent variable) 6-months post-CR

Variable	B	SE B	β
Risk Awareness	0.05	0.74	0.009
Outcome Expectancies - Social	-0.28	1.25	-0.02
Outcome Expectancies - Psychological	-0.31	1.03	-0.05
Outcome Expectancies - Physical	0.57	0.74	0.11
Task Self-efficacy	0.49	0.50	0.14
Scheduling Self-efficacy	0.11	0.48	0.03
Maintenance Self-efficacy	-0.78	0.66	-0.21
Intention	-0.03	0.84	-0.01
Action Planning	-0.81	1.04	-0.16
Coping Planning	1.18	0.70	0.28
Knowledge	0.04	0.05	0.09
Curriculum	2.76	1.34	0.23*

SE indicates standard deviation.
*p<.05