Published in final edited form as:

J Cancer Educ. 2016 December ; 31(4): 749–754. doi:10.1007/s13187-016-1097-z.

Associations between Decisional Balance and Health Behaviors among Adult Cancer Survivors

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Abstract

Interventions directed at health behavior change are increasingly being developed for cancer survivors. This study validates decisional balance measures for physical activity and fruit and vegetable (F/V) consumption among an adult survivorship population. Participants were N=86 patients who completed primary treatment for breast or prostate cancer at least 5 years previously and were enrolled in an e-health intervention that aimed to improve physical activity and nutrition behaviors. Decisional balance, stage of change, F/V consumption, and physical activity were assessed at baseline and 3 months. Factor analysis was used to assess the structure of the decisional balance measures. The relationship between decisional balance, stage, and behavioral outcomes was assessed with mixed model analyses. The two factor structure of each measure was supported. Pros and cons differed across stages of change for both behaviors (p 's < .0001). Total Metabolic Equivalent of Task units (METs) were related to decisional balance pros (p = .012) and cons (p = .003). F/V consumption was significantly associated with decisional balance pros (p = .0003), but not cons (p = .112). Overall, findings provide validation for these decisional balance measures as indicators of health behaviors and support the value of using these measures in further research to aid understanding of behavior change in this population.

Introduction

By 2024 there will be almost 19 million persons in the United States with a history of cancer (cancer survivors), a number that has been steadily increasing due to progress in detection and treatment and the aging of the population [1]. Maintaining optimal health, however, remains a challenge for many survivors due to comorbid conditions as well as effects of treatment such as fatigue and pain [2]. Lifestyle behaviors such as increased physical activity and fruit and vegetable consumption have been associated with improvement in quality of life, vitality, cardiovascular fitness, depression, anxiety, and fatigue [3–6] and even decreased risk of recurrence and improved survival [7]. Based on these data, the American Cancer Society recommends that survivors minimize sedentary time and eat at least 5 servings of fruits and vegetables per day [8]. Despite the potential benefits of such behaviors, the majority of survivors are non-adherent to these recommendations [3]. A number of theory-based interventions to support such lifestyle changes are increasingly being developed as a component of survivorship care plans [9, 10].

The Transtheoretical Model (TTM) has been extensively used to inform behavior change interventions across a broad range of applications. The TTM posits that people progress through five stages of change: precontemplation (not thinking about change), contemplation (starting to think about changes), preparation (making steps toward change), action (actively changing), and maintenance (keeping up changes) [11]. Decisional balance is a key construct of the TTM associated with behavioral changes and is premised on the notion that decision making can be thought of as a conflict between two factors—pros and cons—which influence motivation for a given behavior [12].

Across numerous studies, a systematic relationship has been found between stage of change and decisional balance [12–15]. For a specific behavior, individuals in earlier stages of change ascribe greater importance to cons than to pros; whereas, individuals in action or maintenance stages tend to perceive the pros to be greater than the cons [13]. Pros generally have been found to increase one standard deviation from the precontemplation to action stage, while cons decrease one half of a standard deviation [16, 13]. Previous analyses have illustrated the generalizability of this pattern across a variety of health behaviors including physical activity and diet [17]. Of note, Hall and Rossi [13] conducted a meta-analysis of 120 studies, with 19 focused on exercise and 3 on fruit and vegetable consumption. For exercise, the average effect size was found to be 1.45 ($SE = 0.07$) for pros and 0.54 ($SE = 0.06$) for cons. For fruit and vegetable consumption, the mean effect sizes were 0.95 ($SE = 0.16$) for pros and 0.31 ($SE = 0.17$) for cons.

Only a small number of studies to date have examined the factor structure of decisional balance measures for physical activity and fruit and vegetable intake [12, 14, 15], with none among persons with cancer. Decisional balance measures can be population-specific, since people may attach differing levels of importance to pros and cons of each behavior depending on their circumstances. For instance, cancer survivors may have limitations in physical ability and may weigh the costs of making lifestyle changes against other factors such as maximizing time and desire to return ‘normal’ [18, 19]. In addition, although the literature has established the connection between decisional balance and the stages of change, studies have rarely examined the extent to which decisional balance is correlated with behavioral outcomes. Well-validated measures are essential to increase understanding of processes of behavior change. Therefore, this study aims to examine the construct and external validity of decisional balance measures among a sample of older adult (age 55+) cancer survivors.

Methods

Study Participants

Data for the analysis were derived from a randomized pilot study of an e-health intervention that aimed to increase physical activity and fruit and vegetable consumption among cancer survivors. Participants ($N = 86$) were patients at Memorial Sloan Kettering Cancer Center in New York City who had completed primary treatment for breast or prostate cancer at least 5 years previously. Participants were randomized 1:1 to receive an e-health DVD or usual care advice, with outcomes assessed at baseline and 3 months. In performing the secondary

analysis, participant data from both time points and both arms were combined, controlling for within subject factors.

Measures

Stage of Change—For physical activity, a single multiple choice staging item was used. Participants rated their stage of readiness to engage in regular physical activity or exercise, defined as 3 or more weekly instances of walking briskly, jogging, swimming, bicycling, digging in the garden, or any other physical activity of similar exertion [20]. For fruit and vegetable intake, participants responded to the item “Eating a healthy diet means eating at least 5 fruits or vegetables per day. Do you engage in healthy eating according to that definition?” The options for both included: no intention of starting in next 6 months (precontemplation), intention of starting in next 6 months (contemplation), intention of starting in next 30 days (preparation), engagement in activity for less than 6 months (action) and engagement in activity for more than 6 months (maintenance).

Decisional Balance—Decisional balance was measured with previously-developed instruments for physical activity (16 items) [21] and fruit and vegetable intake (8-items) [22]. Participants responded to the question stem: “Please rate how important each of these statements is in your decision of whether to eat at least 5 fruits and vegetables each day/(be physically active).” The 5-point responses ranged from “Not at all important” to “Extremely Important”. Responses were summed and standardized using T-scores to control for ease of reporting.

Physical Activity—The Godin Leisure-Time Exercise Questionnaire was used to measure physical activity. The questionnaire asks participants to report the number of times per week that they partake in mild, moderate and strenuous physical activity. The reported frequency of these various levels of exercise is then converted into Metabolic Equivalent of Task units (METs) by multiplying each reported instance of mild, moderate and strenuous physical activity by 3, 5, and 9, respectively [23].

Fruit and Vegetable Intake—The Thompson Food Frequency Questionnaire was used to estimate dietary intake [24]. This measure assesses quantity of food consumption by meal (breakfast, lunch, dinner) and computes a score based on the total of each food category. For fruit consumption, scores can range from 0 to 4.5. For vegetable consumption, scores can range from 0 to 6.75. The maximum score is assigned to a participant who reports eating 4 units of fruits/vegetables at every meal, every day of the week. To compute combined fruit and vegetable consumption, the two scores were summed with a total score ranging from 0 to 11.25.

Demographics—Participants reported their age, sex, race, marital status, highest education, occupation, income, and primary cancer diagnosis.

Analyses

Measurement Analysis—Factor analysis was performed with decisional balance items for both behaviors. The analyses employed varimax rotation with squared multiple

correlation to estimate commonalities. Eigenvalues and analysis of residuals was used to assess appropriateness of components extracted.

Furthermore, internal consistency was assessed among the factors isolated. To control for within subject correlation, only observations at baseline were used in the analysis ($N = 85$). The standardized value of Cronbach's coefficient alpha was reported, with values above .80 considered acceptable. All analyses were carried out in SAS 9.3.

Bivariate Analysis—The analyses sought to evaluate the extent to which decisional balance scores for pros and cons differed across stages of change. Mixed models were used to examine significance of the differences across stages for both pros and cons, adjusting for within subject correlation (SAS PROC MIXED). Additionally, the effect size of the maximum difference in decisional balance scores was calculated for both pros and cons for both health outcomes [13]. For pros, the lowest value between precontemplation and action was identified, as well as the highest value following the low. Conversely, for the cons, the highest value between the two stages was identified as well as the lowest following the high. Using these values, a standardized difference was calculated using Hedge's g .

Finally, the association between decisional balance scores and self-reported health behaviors was assessed. For both physical activity and fruit and vegetable outcomes, scores were winsorized to minimize the effect of outliers on the model. Values above three standard deviations from the mean were censored. Mixed model analyses were performed in which both pros and cons scores were evaluated as independent variables to predict each health behavior. Since each health behavior was evaluated across two decisional balance measures, the Bonferroni correction was utilized; the significance criterion was thus set to .025.

Results

Participants

Demographic characteristics of the sample are shown in Table 1. Participants were predominantly non-Hispanic White (81.2%), and female (96.4%), with a mean age of 59.8 ($SD = 11.4$). Recruitment of prostate cancer survivors was limited due to clinic scheduling and change in staffing during the study period. At 3 month follow up 73% (32/44) of the treatment and 86% (36/42) of the control group were available for follow up.

Factor Analysis

Using a minimum eigenvalue of one, the number of factors retained for both the decisional balance for physical activity and the decisional balance for F/V was two. Additionally, all residuals for each item were less than .10 (range .02–.05). These analyses supported the two factor structure of the measures. The pros had strong internal consistencies for both physical activity ($10\text{-item } \alpha = .95$) and F/V ($4\text{-item } \alpha = .81$). The cons had slightly lower internal consistency for both physical activity ($6\text{-item } \alpha = .81$) and F/V ($4\text{-item } \alpha = .78$).

Bivariate Analysis

Decisional Balance and Stage of Change—Figure 1 depicts the relationship between the stages of change for physical activity and decisional balance. Significant differences in the mean decisional balance scores for both pros, $F(5, 65) = 645.9, p < .0001$, and cons, $F(5, 65) = 558.3, p < .0001$, were found across stages of change. Post hoc analyses suggested that both pros and cons scores for participants in the maintenance stage differed significantly from the scores of those in the precontemplation and contemplation stages ($p < .025$). The estimated effect size was 0.99 for pros and -0.99 for cons.

For fruit and vegetables, statistically significant differences were found in mean decisional balance scores for both pros, $F(5, 65) = 546.0, p < .0001$ and cons, $F(5, 65) = 630.3, p < .0001$, across stages of change. Post hoc analyses indicated that the mean pros score for participants in the precontemplation stage differed significantly from the mean scores of those in the preparation, action and maintenance stages ($p < .025$). Similarly, participants in the maintenance stage also had significantly different cons scores compared to the scores of participants in the contemplation and preparation stages ($p < .025$). The estimated effect size was found to be 1.94 for pros and -1.43 for the cons.

Decisional Balance and Behavioral Outcomes—A statistically significant association was found between total METs and both pros score, $F(1, 68) = 6.68, p = .012$, and cons score, $F(1, 68) = 9.63, p = .003$, for physical activity. As shown in Table 2, for each unit increase in METs, pros increased by 0.09 ($SE = 0.04$) and cons decreased by -0.12 ($SE = 0.04$) standardized scores.

Additionally, the combined fruit and vegetable consumption score was significantly associated with both pros, $F(1, 68) = 14.38, p = .0003$, but not cons, $F(1, 68) = 2.609, p = .112$, for fruits and vegetables. For each unit increase in F/V intake, the pros increased by 1.98 ($SE = 0.01$) while cons decreased by -0.92 ($SE = 0.01$).

Discussion

This study sought to examine validity of previously-developed decisional balance measures for use in lifestyle interventions for adult cancer survivors. Analyses supported the two-factor structure of decisional balance, with strong internal consistency for each factor. Consistent with previous research [25, 15, 14], our analysis found that decisional balance scores varied across stage of change. For both health behaviors, individuals in the later stages of change had higher pros and lower cons than individuals in earlier stages of stage. For F/V intake, pros began to outweigh the cons between the preparation and action stages. For physical activity however, a less clear pattern was found. Cons scores for physical activity appear to have leveled off from the preparation to the action stage, which might be attributable to first-time experiences with physical activity. Interestingly, the effect sizes for pros were similar to that of cons for each behavior, in contrast to the strong and weak principles of change, which would predict an effect size of cons of about one half that of pros across stage of change [16]. In this population of older cancer survivors, those who are adherent may rate cons as relatively less important given the benefits of these behaviors in their recovery as compared to other populations who may not have as salient of reasons to be

adherent to activity and fruit and vegetable consumption. Nonetheless, these analyses demonstrate and uphold the predicted relationship between decisional balance and stages of change.

The regression analysis revealed a strong relationship between physical activity and both pros and cons. Increases in METs were found to be associated with increases in decisional balance pros and decreases in decisional balance cons. Fruit and vegetable intake was significantly associated with increases in pros with less clear decreases in relative cons. The cons of F/V intake may not decrease significantly as adherence continues to require adaptation to new eating patterns. Nevertheless, the patterns of increased pros and decreases in cons was seen across both behaviors, providing validation for use of these decisional balance measures in research.

The study has a number of strengths. First, we used previously-developed decisional balance measures for each behavior in order to examine their relevance to this population. Second, we had high follow-up rates. Third, we examined pros and cons not only by stage, but also across behavioral outcomes. In terms of limitations, the population was somewhat homogenous across demographic factors such as gender, race/ethnicity, and education as well as cancer diagnosis. Thus, caution must be exercised when generalizing these findings to a broader population. Additionally, since we winsorized the data in order to minimize the influence of potentially spurious outliers in the self-reported values, the model is not generalizable to extreme values of the health behaviors. Our analysis was able to detect strong associations between decisional balance and the two health behaviors. However, data were analyzed cross-sectionally and does not allow us to determine the causal effect of changes in decisional balance on the health behaviors in question.

Overall, this study supports the relationship between decisional balance measures and physical activity and fruit and vegetable intake in this population of older adult cancer survivors. Decisional balance is a useful indicator of readiness to engage in change and suggests that effective interventions should focus on increasing positive perceptions of behavior change while decreasing the relative importance of barriers to change. Qualitative work can help elucidate the factors the cancer survivors consider in making health-related decisions to better inform intervention development and could inform future refinements to the decisional balance measures. Further analyses with larger sample sizes should examine the extent to which changes in decisional balance mediate changes in stage of change and engagement in health behaviors.

Acknowledgments

We would like to generously thank the staff in the Survivorship Clinic at Memorial Sloan-Kettering Cancer Center for their support throughout the project as well as Michelle Iocolano and Jamie Ostroff, PhD whose guidance and assistance was vital. This project was funded by NCI grant # R03 CA142042 to Paul Krebs, PhD.

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Figure 1.
Relationships between Mean Decisional Balance Scores and Stage of Change for Physical Activity and Fruit/Vegetable Intake

Table 1

Demographic Characteristics of Sample (N =86)

Characteristic	<i>n</i>	%
Age (years) (<i>M</i> =59.8, <i>SD</i> =11.4)		
35–54	29	34.2
55–64	25	29.4
65–74	20	23.5
75+	11	12.9
(Missing)	(1)	
Sex		
Female	82	96.4
(Missing)	(1)	
Primary Cancer Diagnosis		
Breast	83	96.5
Prostate	3	3.5
Married/partnered	59	69.4
(Missing)	(1)	
Race/ethnicity (N=86)		
Non-Hispanic white	69	81.2
Non-Hispanic black	5	5.8
Non-Hispanic Asian	2	2.4
Non-Hispanic other	2	2.4
Multi-racial	2	2.4
Hispanic	5	5.8
(Missing)	(1)	
Employment status		
Employed	41	48.2
Homemaker	7	8.2
Retired or Disabled	35	37.7
Unemployed	2	2.3
(Missing)	(1)	
Education		
High school	7	8.2
Some college	21	24.7
College graduate	18	21.2
Graduate degree	39	45.9
(Missing)	(1)	
Income (\$)		
10–29k	4	4.8
30–49k	7	8.3
50–69k	12	14.3
70–89k	14	16.6

Characteristic	<i>n</i>	%
90k+	47	56.0
(Missing)	(2)	

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Table 2

Fixed Effects Solution for Association between Decisional Balance Scores and Physical Activity and Fruit and Vegetable Consumption

		Effect Estimates		
	Parameter	β	SE	p
METs	Intercept	47.51	1.34	<.0001
	Pros Score	0.09	0.04	.012
	Intercept	53.09	1.31	<.0001
	Cons Score	-0.12	0.04	.003
F/V Consumption	Intercept	45.78	1.44	<.0001
	Pros Score	1.98	0.52	.0003
	Intercept	51.95	1.56	<.0001
	Cons Score	-0.92	0.57	0.112

METs = Metabolic Equivalent of Task units