Application of the Theory of Planned Behaviour to understand physical activity intentions and behavior among Korean breast cancer survivors

Jihee Min
Yonsei University Wonju Medical College: Yonsei University Wonju College of Medicine
Ye-Won Yu
Yonsei University
Jeongmin Lee
Yonsei University
Sujin Yeon
Yonsei University
Ha-Nui Park
Yonsei University
Joon Sung Lee
Yonsei University
Kerry S. Courneya
University of Alberta Faculty of Kinesiology Sport and Recreation
Hyung Seok Park
Yonsei University College of Medicine
Seung Il Kim
Yonsei University College of Medicine
Justin Jeon (jjeon@yonsei.ac.kr)
Yonsei University https://orcid.org/0000-0001-7978-4271

Research Article

Keywords: Breast cancer survivors, physical activity, Theory of Planned Behavior

Posted Date: April 11th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1436822/v1

Abstract

Purpose: The purpose of this study was to apply the Theory of Planned Behavior (TPB) to understand physical activity intentions and behaviors among Korean breast cancer survivors.

Methods: A total of 286 Korean breast cancer survivors (M_{age}52.3±8.3) completed a self-reported survey administered face-to-face by a trained interviewer. The survey assessed the physical activity frequency and intensity in a typical week after breast cancer diagnosis, demographic factors, and theory of planned behavior variables including attitude, subjective norm, perceived behavioral control (PBC), planning, and intentions to participate in physical activity. We used structural equation modeling to examine the direct and indirect effects of the TPB variables on physical activity intentions and behavior. Covariates included age, cancer stage, and clinical treatment.

Results: Confirmatory factor analyses indicated a satisfactory model fit. We observed direct effects for instrumental attitude (ß=0.34, p<0.001), subjective norm (ß=0.12, p<0.05), and PBC (ß=0.57, p<0.001) on physical activity intentions. PBC (ß=.17, p<0.01) and physical activity intentions (ß=0.46, p<0.01) had direct effects on planning. PBC (ß=0.28, p<0.01) and planning (ß=0.22, p<0.01) had direct effects on physical activity behavior.

Conclusion: The TPB was a useful model for understanding Korean breast cancer survivors' physical activity intentions and behavior. Interventions that can enhance attitudes, subjective norm, PBC, intention, and planning may facilitate physical activity intentions and behaviors in this population.

Introduction

Globally, over 1.5 million women are diagnosed with breast cancer every year [1]. In Korea, breast cancer incidence rates have increased by 17% (from 11–28%) from 1999 to 2017. The breast cancer incidence rate has increased yearly, but early detection and advanced medical treatment have decreased mortality rates [2]. The five-year relative survival rate has increased from 79.2–93.2% during the last two decades.

Motivating breast cancer survivors to initiate and maintain a physically active lifestyle is important for promoting health outcomes after breast cancer diagnosis. Research strongly suggests physical activity may both prevent breast cancer and improve survival after breast cancer [3–6]. Other common benefits of activity for breast cancer survivors include improved aerobic fitness, physical function, muscular strength, body composition, health-related quality of life, mental health, and fatigue [7–11]. Despite the evidence, most breast cancer survivors remain physically inactive. Breast cancer survivors should achieve the American College of Sports Medicine recommendation of at least 150 minutes of moderate-to-vigorous intensity physical activity per week [12]. Research consistently suggests that only 10 to 15% of breast cancer survivors meet the activity guidelines [13].

Efforts to understand why breast cancer survivors remain inactive often focus on sociodemographic (e.g., age, education) and clinical (e.g., types of treatment received, body weight) characteristics. Social cognitive approaches have provided researchers with a more complete understanding of factors influencing activity motivation and also provide targets for interventions. The theory of planned behavior (TPB) has been a widely used theory to understand physical activity motivation and behavior in various cancer populations [14–18]. The TPB [19] proposes that an individual's *intention* to participate in behavior is the main determinant of engaging in the behavior. Three conceptually independent variables directly influence intention: *attitude*, *subjective norm*, and *perceived behavioral control* (PBC). Several studies of cancer survivors have suggested that the TPB explains 21–38% of the variance in physical activity behavior and 23–62% of the variance in physical activity intention [17, 20, 21]. The TPB has not been used to understand the correlates of physical activity among Korean breast cancer survivors.

Previous studies of breast cancer survivors examining the TPB and physical activity have primarily relied on multivariate statistical procedures (e.g., linear regression), which have examined the components of the TPB model rather than evaluating the model's overall fit. Our study used structural equation modeling (SEM) to test the TPB model. We expect SEM will be more beneficial in understanding structural relationships between TPB components and physical activity among breast cancer survivors.

The primary purpose of our study was to examine structural relationships between TPB constructs (i.e., attitudes, subjective norm, perceived behavior control) and physical activity intentions and behavior among Korean breast cancer survivors. We hypothesized that there are direct effects for TPB constructs on physical activity intentions, and intention has effect on physical activity behavior among Korean breast cancer survivors.

Methods

Participants and procedure

We recruited breast cancer survivors from the Yonsei Severance Hospital (Seoul, Korea) between July and October 2018. Among breast cancer survivors who were on outpatient visits to the department of the breast cancer center, women who were approved by the doctor as suitable subjects to participate in the study were recruited. Participants were eligible if they were < 75 years of age, had histologically confirmed stage <Ⅲ breast cancer, completed treatments (i.e., surgery, radiotherapy, chemotherapy) within three months of study enrolment, and understood and provided written informed consent in Korean. Each participant completed a face-to-face survey with a trained interviewer. The study protocol was approved by the Institutional Review Board of Severance Hospital [No. 4-2018-0379]. All participants provided written informed consent.

Sociodemographic and clinical variables

Demographic and clinical variables were collected using a self-reported questionnaire and reviewing electrical medical records. Demographic information included age, education, income, and marital status. Clinical data included body mass index (BMI), breast cancer stage, treatment(s) received, surgery method, and surgery site.

Theory of planned behavior variables

We used TPB questionnaires developed by Courneya et al. [22, 23] and translated the questions resulting in a Korean version of the TPB questionnaire (K-TPB). The original questionnaire was translated into Korean by two independent bilingual experts who have doctoral degrees in public health and exercise physiology. After the translation, a panel (N = 3) consisting of nursing, public health, and exercise science professors reviewed each question and derived the first version of K-TPB. The K-TPB underwent backward translation into English by two independent scholars. Panels of experts compared the original TPB and the back-translated K-TPB. The panel discussion adjusted semantic nuance words or sentences to reflect cultural differences (K-TPB second version). We then conducted a pilot test to examine the validity of the final version with 200 BCS. Exploratory factor analysis indicated each subscale showed adequate internal consistency (Cronbach's alpha > 0.6) (affective attitude = 0.88, instrument attitude = 0.79, subjective norms = 0.87, PBC = 0.65, intention = 0.75; Kaiser Meyer Olkin = 0.81; $p < 0.001$).

Attitude reflects the individual's overall evaluations of performing the behavior. Six items assessed attitude, and participants responded on a seven-point Likert scale with the descriptors of extremely (1 and 7), quite (2 and 6), slightly (3 and 5), and neutral (4). Attitude was measured in two components including affective (i.e., enjoyable/unenjoyable, pleasurable/painful, and fun/boring) and instrumental (i.e., useful/useless, beneficial/harmful, and important/unimportant) attitudes. The statement preceded each item, 'I think that for me to participate in regular physical activity (or exercise) over the next month would be…'. Internal consistency for affective and instrumental attitude was 0.87 and 0.76, respectively (see Supplementary Table).

Subjective norm reflects the perceptions of social pressure to perform the behavior. Subjective norm includes the more traditionally measured injunctive component (e.g., individual believes important others want them to perform the behavior) and a descriptive component (e.g., whether important others perform the behavior themselves). Four items assessed *subjective norm*, and participants responded on a seven-point Likert scale with the descriptors of extremely (1 and 7), quite (2 and 6), slightly (3 and 5), and neutral (4). The three injunctive norm items were preceded by 'I think that if I engaged in regular physical activity (or exercise) over the next month, most people who are important to me would… (a) approve (1 = extremely disapproving to 7 = extremely approving), (b) support (1 = extremely unsupportive to 7 = extremely supportive), and (c) encourage (1 = extremely discouraging to 7 = extremely encouraging)'. The statement preceded the descriptive norm item, 'I think that over the next month, most people who are important to me will regularly participate in physical activity (or exercise)' (1 = strongly disagree to 7 = strongly disagree). In this study, we used the injunctive norm items and removed the descriptive norm item due to issues with convergent validity in the confirmatory factor analysis. As measured by Cronbach's α, internal consistency for the injunctive norm items was 0.88 (see Supplementary Table).

PBC reflects the degree of personal control the individual has over performing the behavior. Three items assessed PBC. The statement preceded all items, 'If you were really motivated…', followed by (a) How much control would you have over doing regular physical activity (or exercise) over the next month? (1 = very little control to 7 = complete control), (b) Is it entirely up to you to participate in regular physical activity (or exercise) for the next month?' (1 = no, not at all to 7 = entirely depends on me), and (c) How confident are you that

you could do regular physical activity (or exercise) over the next month?' (1 = no, not at all confident to 7 = complete confidence). The internal consistency for PBC was 0.62 (see Supplementary Table).

Intention

Intention is the most proximal determinant of behavior. Two items and one planning item measured intentions to engage in physical activity. The two items were (a) Do you intend to do regular PA (or exercise) over the next month? (1 = no, not really to 7 = strongly intend) and b) How motivated are you doing regular physical activity over the next month? (1 = not at all motivated to 7 = extremely motivated). The internal consistency of this scale was 0.82. The planning question was 'Do you have plans for when, where, and the type of physical activity (or exercise) you will do in the next month?' (1: no specific plans to 7: very detailed plans). The internal consistency for planning was 0.80 (see Supplementary Table).

Physical activity behavior was measured using the 16-item Korean version of the Global Physical Activity Questionnaire (GPAQ) developed by the World Health Organization [24]. The GPAQ asks participants about physical activities (including exercise) performed for at least 10 minutes during a typical week. Participants report on time spent being physically active at the (a) workplace, (b) during transportation, (c) during leisure, and sedentary behavior. Physical activity is expressed in metabolic equivalent values (METs) in accordance with the GPAQ analysis guideline (e.g., vigorous activity = 8METs, moderate activity = 4METs, transportation activity = 4METs). Among the physical activity parameters, leisure time moderate to vigorous physical activity (MVPA) was used for Examining for TPB model. The Korean version of the GPAQ has previously demonstrated evidence of reliability and validity [25].

Statistical analysis

Participants' demographic, medical/clinical, physical activity, and TPB variables were summarized using descriptive statistics. Pearson's correlations examined associations between TPB constructs and physical activity behavior constructs. Medium to large relationships were defined as $r = 0.3$ to 0.5 [26]. Statistical tests were two-sided ($\alpha = 0.05$). We used SPSS 22.0 (IBM Corporation, Armonk, NY) for all statistical analyses. We also used PASW Statistics 19 (PASW Inc., Chicago, IL) and AMOS 19.0 (Small Waters Corp., Chicago, IL). The maximum likelihood estimation of SEM was conducted to allow for both an assessment of overall model fit and statistical significance tests for the size of each theoretical relation in the TPB model. Model fit was examined using a number of indices such as chi-square index, goodness-of-fit index (GFI), adjusted goodness-of-fit (AGFI), root mean square of approximation (RMSEA), and comparative fit index (CFI).

Results

Participants' characteristics and descriptive analysis

We approached 332 breast cancer survivors and 299 consented to participate in this study (response rate 90%). Out of 299 participants, 286 completed the survey and provided complete data. Table 1 shows participant characteristics. The mean age of the sample was 52.3 ± 8.3 years, and the average BMI was 23.4 ± 3.3kg/m^2. Among the participants, 71.7% were diagnosed with stage 0 or 1 breast cancer, and 38.5% of participants had received surgery, chemotherapy, and radiation therapy. Less than half the sample (42.7%) met ACSM physical activity guidelines. The average total MVPA across the GPAQ domains was 289.7 ± 509.5 minutes/weeks, and the mean leisure MVPA was 168.3 ± 202.1 minutes/weeks. Leisure MVPA had the highest correlation with intentions to engage in physical activity ($r = 0.33$, $p < 0.01$).

Table 1
Participant's characteristics

Variables	Total (n = 286)
Demographic	
Age (year)	52.30 ± 8.26
Height (cm)	158.04 ± 5.22
Weight (kg)	58.50 ± 8.61
BMI (kg/m^2)	23.44 ± 3.25
Education (n,%)	
≤ Middle school	32 (11.2)
High school	119 (41.6)
≥ College	119 (41.6)
No response	16 (5.6)
House income (n,%)	
No income	27 (9.5)
< 1,000,000 (won)	4 (1.4)
1,010,000 ~ 3,000,000	59 (20.6)
3,010,000 ~ 5,000,000	85 (29.7)
≥ 5,010,000	97 (33.9)
No response	14 (4.9)
Marital status (n,%)	
Single	27 (9.4)
Married	217 (76.0)
Bereavement	21 (7.3)
Divorce	14 (4.9)
No response	7 (2.4)
Cancer stage (n,%)	
0	44 (15.4)
□	161 (56.3)
□	71 (24.8)
□	10 (3.5)
Clinical treatment (n,%)	
Only surgery (including reconstruction surgery)	56 (19.6)
Surgery + chemotherapy	36 (12.6)
Surgery + radiation therapy	83 (29.1)
Surgery + chemotherapy + radiation therapy	110 (38.5)
Un-reported	1 (0.3)

Variables	Total (n = 286)
Surgery method (n,%)	
MRM	67 (23.4)
TM with SLNB	45 (15.7)
PM with ALND	68 (23.9)
PM with SLNB	97 (33.9)
Un-reported	9 (3.1)
Site of surgery (n,%)	
Right	142 (49.7)
Left	131 (45.8)
Both	9 (3.1)
Un-reported	4 (1.4)
Physical activity level (min/week)	
VPA at workplace	1.68 ± 28.38
MPA at workplace	119.34 ± 474.48
Transport related PA	168.29 ± 193.43
VPA in leisure	16.85 ± 89.96
MPA in leisure	151.33 ± 189.48
VPA	18.53 ± 94.03
MPA	271.09 ± 505.81
MVPA	289.68 ± 509.54
Total PA	456.04 ± 559.94
Leisure PA/Total PA (%)	40.82 ± 36.93
Sedentary behavior	525.02 ± 244.42
ACSM PA guideline (n, %)	
Meet	122 (42.7%)
Variables are presented Mean ± SD or N (%), physical activity: data presented as Mean ± SD min/week, abbreviation: MRM; Modified Radical Mastectomy, TM with SLNB; Total Mastectomy with Sentinel Lymph Node Biopsy, PM with ALND; Partial Mastectomy with Axillary Lymph Node Dissection, PM with SLNB; Partial Mastectomy with Sentinel Lymph Node Biopsy, VPA; Vigorous physical activity (VPA at workplace + VPA in leisure), MPA: moderate physical activity (MPA at workplace + MPA in leisure), Total PA; sum of all physical activity factors, ACSM PA guideline; American College of Sports Medicine (ACSM) physical activity guidelines (≥ 150 min/week of moderate to vigorous physical activity per week),	

Table 2 indicates correlations between TPB parameters and physical activity. TPB variables were significantly correlated with intention, while PBC, intention, and planning were correlated with leisure MVPA.

Table 2
The correlation among TPB parameters and PA in breast cancer survivors

	Instrumental attitude	Affective attitude	Subjective norm	Perceived behavior control	Intention	Planning	Total PA	MVPA	MVPA in leisure	Mean ± SD
Instrumental attitude	1.00	0.51**	0.33**	0.32**	0.40**	0.26**	0.03	0.05	0.06	6.50 ± 0.65
Affective attitude		1.00	0.18**	0.29**	0.28**	0.18**	0.08	0.08	0.11	5.72 ± 1.13
Subjective norm			1.00	0.16**	0.21**	0.14*	0.11	0.01	0.04	6.58 ± 0.72
Perceived behavior control				1.00	0.50**	0.40**	0.07	0.06	0.32**	5.47 ± 1.05
Intention					1.00	0.85**	0.13*	0.16**	0.33**	5.89 ± 1.10
Planning						1.00	0.15**	0.17**	0.33**	5.40 ± 1.76
Total PA							1.00	0.94**	0.33**	456.04 ± 559.94
MVPA								1.00	0.35**	289.68 ± 509.54
MVPA in leisure									1.00	168.25 ± 202.09

Theory planned behavior factors rated on 7-point (1 to 7) scales, Total PA; total physical activity (moderate to vigorous physical activity at work + Transport related physical activity + moderate to vigorous physical activity in leisure per week), MVPA; moderate physical activity + vigorous physical activity, *$p < 0.05$, **$p < 0.01$

Before testing the proposed structural model, confirmatory factor analysis (CFA) was conducted as the sample size (n = 286) was larger than the recommended minimum sample size (~ 100 to 150 participants) [27]. The results of the CFA showed a satisfactory level of fit (S-B χ^2/df ratio = 134.134/56 = 2.395; CFI = .96; TLI = .94; RMSEA = .07; SRMR = .05. Figure 1 shows the standardized direct and indirect effect coefficients for the associations of the TPB variables on intention and physical activity behavior. The model fit indices met satisfactory levels based on suggested criteria (i.e., S-B χ^2/df = 356.079/129 = 2.76; CFI = .88; NNFI = .86; RMSEA = .08; SRMR = .15). We observed direct effects for instrumental attitude (ß=0.34, $p < 0.001$), subjective norm (ß=0.12, $p < 0.05$), and PBC (ß=0.57, $p < 0.001$) on physical activity intentions. PBC (ß=.17, $p < 0.01$) and physical activity intentions (ß=.46, $p < 0.01$) had direct effects on planning. PBC (ß=0.28, $p < 0.01$) and planning (ß=0.22, $p < 0.01$) had direct effects on physical activity behavior. Physical activity intentions did not have any significant direct effects on physical activity behavior. Overall, the TPB accounted for 44% of the variance in physical activity intentions, and 12% of the variance physical activity behavior.

Discussion

The primary purpose of our study was to examine structural relationships between TPB constructs (i.e., attitudes, subjective norms, perceived behavior control) and physical activity intentions and behavior among Korean breast cancer survivors. Overall, the TPB model demonstrated an adequate-to-good fit to the data. SEM analyses indicated significant effects of instrumental attitude, subjective norm, and PBC on physical activity intentions. There were significant model pathways from PBC to planning and physical activity behavior (PBC had stronger effects than planning). PBC demonstrated the strongest effects, followed by instrumental attitude and subjective norm.

In our study, attitude, subjective norm, and PBC accounted for 44% of the variance in physical activity intentions. These variables only explained 12% of the variance in physical activity behavior. These estimates are consistent with previous research examining the utility

of the TPB among breast cancer survivors. Other studies reported estimates ranging from 11% [28] to 43% [29]. The wide range in variance explained by the TPB variables may be due to several factors. Differences between these studies include (a) varying sample sizes across the studies, (b) different self-report questionnaires were used to measure physical activity behavior, and (c) sample sizes may differ for sociodemographic (e.g., age, education) and clinical variables (e.g., during treatment versus post-treatment, types of treatments received). Future research should explore other factors related to intentions and physical activity behavior given that the majority of variance is left unexplained. Participant personality and environmental factors may help further explain breast cancer survivors' physical activity intentions and behavior [29].

In contrast to previous research, we did not observe a significant model pathway from physical activity intentions to physical activity behavior. The TPB postulates that intention is the most important determinant of behavior [19]. The lack of a direct effect between the two variables was unexpected. In their sample of breast cancer survivors undergoing treatment, Courneya and Friedenreich found physical activity intentions and PBC were independent predictors of physical activity behavior, explaining 14% of the variance [23]. Among 524 rural breast cancer survivors in Canada, Vallance and colleagues reported that physical activity intentions explained 12% of the variance in physical activity behavior [29]. In breast and prostate cancer survivors, Blanchard and colleagues reported physical activity intentions explained 32% of the variance in physical activity behavior [22]. Most similar to our study, Forbes and colleagues surveyed 248 breast cancer survivors in Canada and found intentions were not associated with physical activity behavior, and PBC was associated with intentions [28]. Some reasons may explain the differences seen in our findings. These studies (a) used multiple regression analyses, which may not consider the overall fit of the TPB model, and (b) did not have a *planning* construct, which may mediate associations between physical activity intentions and physical activity behavior. Although physical activity intentions were not directly related to physical activity behavior, we found a significant model pathway from physical intentions to planning, and planning to physical activity behavior. These pathways suggest physical activity intentions were indirectly related to physical activity behaviors and partially mediated by planning.

Our study has several strengths and limitations that warrant mentioning. To the best of our knowledge, our study is the first to examine the correlates of physical activity in Asian breast cancer survivors and one of the first to use SEM to investigate the utility of the TPB in understanding physical activity among breast cancer survivors. SEM has several advantages (e.g., statistical evaluation of the theoretical model, mediating variable utilization) over more traditional analyses (e.g., correlations, linear/multiple regression). Future research should continue to use this approach. We achieved a high response rate as over 90% of individuals invited participated in our survey. We suspect one of the reasons for the high response rate may be culturally related. The doctor-patient relationship in Asian culture has been described as a paternalistic or *one-way style* with a dominant role for the doctor [30, 31]. The main limitation of our study is the cross-sectional study design. Researchers should incorporate a temporal sequence between measures (i.e., longitudinal/prospective methods) to determine causality between physical activity intentions, planning, and physical activity behavior. Using a self-reported physical activity questionnaire rather than device-measured physical activity (e.g., accelerometers) is another limitation of our study. People tend to over-report their physical activity levels due to recall difficulties.

Our study suggests the TPB is a useful model to explain physical activity intentions in a sample of Korean breast cancer survivors. Our findings showed physical activity intentions indirectly influenced physical activity behavior through planning while PBC directly influenced physical activity behavior. Instrumental attitudes, subjective norms, and PBC all influenced physical activity intentions. PBC appears to be the most important construct (among the TPB variables), given the direct and indirect effects observed on physical activity behavior among Korean BCS. Given the benefits of physical activity for breast cancer survivors, physical activity motivation and adherence need to be further studied and considered. Strategies to enhance motivational beliefs (i.e., TPB constructs), especially perceived behavioral control, should be developed, tested, and implemented to facilitate physical activity behavior change in this population.

Declarations

Authors' contribution

J.M., Y.Y., S.K., K.S., and J.J. conceptualised the study. J.M., Y.Y., S.Y., H.N.P., H.P. and S.K. recruited participants. J.M., Y.Y., S.Y. and H.N.P conducted the survey. J.M., J.L., J.S.L., and J.J. analysed the data and prepared the manuscript. All authors reviewed the fnal manuscript.

Funding

n/a

Availability of data and material

Data are available upon request to the corresponding author.

Code availability

n/a

Ethics approval

This study was approved by the Institutional Review Board of Severance Hospital [No. 4-2018-0379].

Consent to participate

Informed consent was obtained from all individual participants included in the study

Consent for publication

Informed consent was obtained from all individual participants for their data to be included in journal publications.

Conflicts of Interest

The authors declare no competing interests.

Financial disclosure

No financial disclosures were reported by the authors of this paper.

References

1. International Agency for Cancer Research (IARC) press (2003) In: Stewart B, Kleihues P (ed) World cancer report, Vol 57, Lyon
2. Hong S, Won YJ, Park YR, Jung KW, Kong HJ, Lee ES (2020) Cancer statistics in Korea: incidence, mortality, survival, and prevalence in 2017. Cancer Res Treat 52:335–350
3. Friedenreich C, Shaw E, Neilson HK, Brenner DR (2017) Epidemiology and biology of physical activity and cancer recurrence. J Mol Med 95:1029–1041
4. Lahart I, Metsios GS, Nevill AM, Carmichael AR (2015) Physical activity, riskof death and recurrence in breast cancer survivors: a systematic review and meta-analysis of epidemiological studies. Acta Oncol 54:635–654
5. Spei M, Samoli E, Bravi F, La Vecchia C, Bamia C, Benetou V (2019) Physical activity in breast cancer survivors: a systematic review and meta- analysis on overall and breast cancer survival. Breast 44:144–152
6. Zhong S, Jiang T, Ma T, Zhang X, Tang J, Chen W, Lv M, Zhao J (2014) Association between physical activity and mortality in breast cancer: a meta-analysis of cohort studies. Eur J Epidemiol 29:391–404
7. Kang D, Lee J, Suh SH, Ligibel J, Courneya KS, Jeon JY (2017) Effects of exercise on insulin, IGF axis, adipocytokines, and inflammatory markers in breast cancer survivors: a systematic review and meta-analysis. Cancer Epidemiol Biomarkers Prev 26:355–365
8. McNeely M, Campbell KL, Rowe BH, Klassen TP, Mackey JR, Courneya KS (2006) Effects of exercise on breast cancer patients and survivors: a systematic review and meta-analysis. CMAJ 175:34–41
9. Schmid D, Leitzmann MF (2014) Association between physical activity and mortality among breast cancer and colorectal cancer survivors: a systematic review and meta-analysis. Ann Oncol 25:1293–1311
10. Schmidt M, Wiskemann J, Ulrich CM, Schneeweiss A, Steindorf K (2017) Self-reported physical activity behavior of breast cancer survivors during and after adjuvant therapy: 12 months follow-up of two randomized exercise intervention trials. Acta Oncol 56:618–627
11. Brown W (2015) Exercise-associated DNA methylation change in skeletal muscle and the importance of imprinted genes: a bioinformatics meta-analysis. Br J Sports Med 49:1567–1578

12. Campbell K, Winters-stone KM, Wiskemann J, May AM, Schwartz AL, Courneya KS, Zucker DS, Matthews CE, Ligibel JA, Gerber LH, Morris GS, Patel AV, Hue TF, Perna FM, Schmitz KH (2019) Exercise guidelines for cancer survivors: concensus statement from international mltidisciplinary roundtable. Med Sci Sports Exerc 42:1409–1426
13. Sabiston C, Brunet J, Vallance JK, Meterissian S (2014) Prospective examination of objectively assessed physical activity and sedentary time after breast cancer treatment: sitting on the crest of the teachable moment. Cancer Epidemiol Biomarkers Prev 23:1324–1330
14. Emery C, Yang HC, Frierson GM, Peterson LJ, Sug S (2009) Determinants of physical activity among women treated for breast cancer in a 5-year longitudinal follow-up investigation.Psychooncology18:377–386
15. Jones L, Guill B, Keir ST, Carter K, Friedman HS, Bigner DD, Reardon D (2007) Using the theory of planned behavior to understand the determinants of exercise intention in patients diagnosed with primary brain cancer. Psychooncology 16:232–240
16. Karvinen K, Courneya KS, Campbell KL, Pearcey RG, Dundas G, Capstick V, Tonkin KS (2007) Correlates of exercise motivation and behavior in a population-based sample of endometrial cancer survivors: an application of the Theory of Planned Behavior. Int J Behav Nutr Phys Act 4:21
17. Karvinen K, Courneya KS, Plotnikoff RC, Spence JC, Venner PM, North S (2009) A prospective study of the determinants of exercise in bladder cancer survivors using the Theory of Planned Behavior. Support Care Cancer 17:171–179
18. Stacey F, James EL, Chapman K, Courneya KS, Lubans DR (2015) A systematic review and meta-analysis of social cognitive theory-based physical activity and/or nutrition behavior change interventions for cancer survivors.J Cancer Surviv9:305–338
19. Ajzen I (1991) The Theory of Planned Behavior. Org Behav Human Dec Proc 50:179–211
20. Keats M, Culos-Reed SN, Courneya KS, McBride M (2007) Understanding physical activity in adolescent cancer survivors: an application of the Theory ofPlanned Behavior. Psychooncology 16:448–457
21. Speed-Andrews A, Rhodes RE, Blanchard CM, Culos-Reed SN, Friedenreich CM, Belanger LJ, Courneya KS (2012) Medical, demographic and social cognitive correlates of physical activity in a population-based sample of colorectal cancer survivors. Eur J Cancer Care 21:187–196
22. Blanchard CM, CK, Rodgers WM, Murnaghan DM (2002) Determinants of exercise intention and behavior in survivors of breast and prostate cancer: an application of the theory of planned behavior. J Cancer Nursing 25:88–95
23. Courneya K, Friedenreich CM (1999) Utility of the Theory of Planned Behavior for understanding exercise during breast cancer treatment. J Psych Onc 8:112–122
24. World Health Organization (2012) Global Physical Activity Questionnaire (GPAQ) analysis guide. World Health Organization, Geneva, pp 1–22
25. Lee J, Lee C, Min J, Kang DW, Kim JY, Yang HI, Park J, Lee MK, Lee MY, Park I, Jae SY, Jekal Y, Jee SH, Jeon JY (2019) Development of the Korean Global Physical Activity Questionnaire: reliability and validity study. Glob Health Promot 27:44–55
26. Cohen J (2013) Statistical power analysis for the behaviors science, 2nd edn. Routledge, pp 110–139. https://doi.org/10.4324/9780203771587
27. Anderson J, Gerbing DW (1988) Structural equation modeling in practice: a review and recommended two-step approach. Psychol Bull 103:411–423
28. Forbes C, Blanchard CM, Mummery WK, Courneya KS (2014) A comparison of physical activity correlates across breast, prostate and colorectal cancer survivors in Nova Scotia, Canada. Support Care Cancer 22:891–903
29. Vallance J, Lavallee C, Culos-Reed NS, Trudeau MG (2012) Predictors of physical activity among rural and small town breast cancer survivors: an application of the Theory of Planned Behaviour. Psychol Health Med 17:685–697
30. Blackhall L, Murphy ST, Frank G, Michel V, Azen S (1995) Ethnicity and attitudes toward patient autonomy. JAMA 274:820–825
31. Claramita M, Nugraheni MDF, van Dalen J, van der Vleuten C (2013) Doctor-patient communication in Southeast Asia: a different culture? Adv Health Sci Educ Theory Pract 18:15–31

Figures

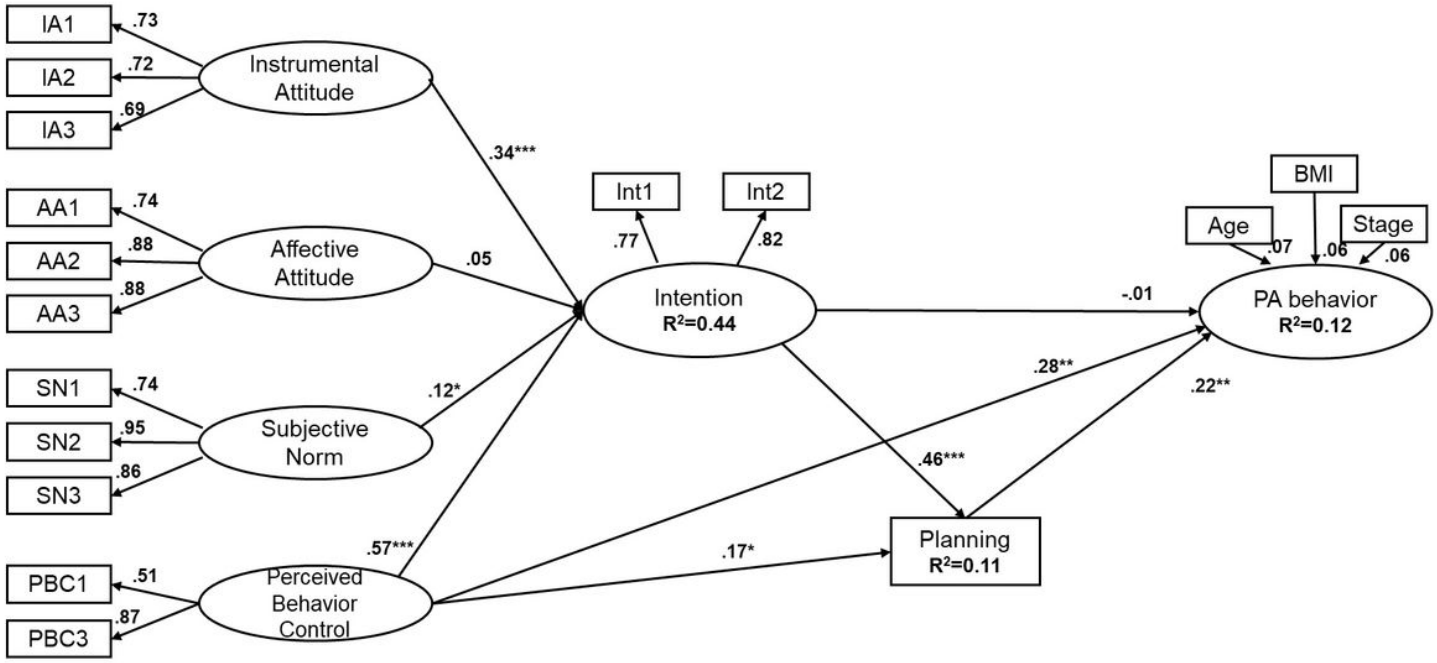

Figure 1

Standardized parameter estimates for pathways among Theory of Planned Behavior in breast cancer survivors.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupportiveCareinCancersupplementarytable220301.docx