

The contribution of general and cancer-related variables in explaining physical activity in a breast cancer population 3 weeks to 6 months post-treatment

Caroline Charlier^{1,2}, Elke Van Hoof^{3,4}, Evelyn Pauwels¹, Lilian Lechner², Heleen Spittaels¹ and Ilse De Bourdeaudhuij^{1*}

¹Faculty of Medicine and Health Sciences, Department of Movement and Sport Sciences, Ghent University, Ghent, Belgium

²Faculty of Psychology, Open University of the Netherlands, Heerlen, The Netherlands

³Faculty of Psychological and Educational Sciences, Free University of Brussels, Brussels, Belgium

⁴Belgian Cancer Centre, Scientific Institute of Public Health, Brussels, Belgium

*Correspondence to:

Department of Movement and Sports Sciences, Ghent University, Watersportlaan 2, 9000 Gent, Belgium. E-mail: ilse.debourdeaudhuij@ugent.be

Abstract

Objective: Physical activity determinants are subject to change when confronted with the diagnosis of 'cancer' and new cancer-related determinants appear. The aim of the present study is to compare the contribution of cancer-related determinants with more general ones in explaining physical activity 3 weeks to 6 months post-treatment.

Methods: A theory-based and validated questionnaire was used to identify physical activity levels (total and domain-specific) and associated determinants among 464 breast cancer survivors (aged 18 to 65 years) 3 weeks to 6 months post-treatment.

Results: Descriptive analyses showed higher scores for general determinants in comparison with cancer-related determinants. Nevertheless, regression analyses showed that both general and cancer-related determinants explained total and domain-specific physical activity. Self-efficacy, enjoyment, social support, lack of time and lack of company were important general determinants. The perception of returning to normal life, cancer-related barriers (fatigue, lack of energy and physical side effects) and self-efficacy in overcoming these barriers were important cancer-related determinants. Although results differed according to the women's working status and the physical activity domain, general self-efficacy explained most physical activity types in both groups.

Conclusion: Comparable with the general population, enhancing breast cancer survivors' self-efficacy in being sufficiently physically active seems to be important in physical activity interventions post-treatment. However, interventions should be tailored to the experienced symptoms and working status of the women.

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Introduction

The increasing survival rates among breast cancer patients [1–4] lead to a growing number of breast cancer survivors [5]. Although some of them recover with a renewed sense of life, most survivors also suffer from a variety of medical, functional and psychosocial consequences of breast cancer and its treatment [6,7]. Therefore, physical and psychosocial interventions are warranted to facilitate full recovery [8]. Physical activity (PA) can assist recovery [9,10]. To obtain the health benefits of PA, such as increased quality of life and improved survival [11–16], cancer survivors should be moderately physically active for at least 30 min, 5 days per week [17]. Unfortunately, many survivors do not meet this recommendation [18,19]. Therefore, PA promotion in cancer survivors is warranted [20].

The transition period from patient to survivor is seen as an ideal period for health promotion because it represents a time for self-reflection and personal change [21,22]. Knowledge of the psychosocial predictors of PA in survivors in this specific period (<6 months post-treatment) is necessary for the development of future interventions as well as to identify those survivors who may need help in their adoption of a healthy lifestyle.

Within the general population, attitude, social influences and self-efficacy are important variables in explaining PA [23]. Attitude is an individual's evaluation of self-performance of an active lifestyle and can be determined by a total set of behaviour beliefs (perceived benefits and barriers). Social influence addresses the perception of significant others on PA (subjective norm), the extent to which significant others are participating in PA (modelling) and the perceived support.

Self-efficacy is defined as a patient's own belief in his or her ability to be sufficiently physically active and the confidence in the ability to overcome barriers to PA participation.

Descriptive studies on cancer patients' perceived benefits and barriers, social influences and self-efficacy showed some differences in comparison with those of the general population [24–26]. One study suggested that breast cancer survivors reported higher perceived benefits and barriers for PA [26], but results are mixed [27]. Other studies confirmed the presence of an additional set of PA determinants specifically related to the women's health status [26,28–30]. However, the importance of these cancer-related determinants in explaining PA in cancer survivors remains unclear. Further research is needed to clarify how both general and cancer-related determinants explain PA to allow for better tailoring of future interventions.

The first aim of the present study is to explore the general and cancer-related determinants of PA in a breast cancer population within 6 months post-treatment. Secondly, the contribution of the cancer-related determinants in comparison with the more general ones in explaining total and domain-specific PA will be investigated.

Method

Participants and procedures

Patients were referred through several Belgium hospitals. Breast cancer survivors eligible for participation were (a) aged 18 to 65 years, (b) survivors of primary non-metastatic breast cancer, (c) 3 weeks to 6 months post-treatment (surgery, chemotherapy and/or radiation therapy) and (d) Dutch speaking. Pregnancy and severe neurological, psychological and cognitive dysfunctions were exclusion criteria. Younger women often report very different recovery and re-integration issues and other physical problems than older women [31]. As differentiating between the two age groups would be too complicated for this study, survivors of retiring age were not the focus of this study. Informed consent was obtained from all participants, and the participants were given questionnaires, followed by a reminder after 2 weeks. Ethical clearance was obtained from the ethical committee of Ghent University (B67020096619).

Questionnaires

Basic demographic, educational and medical information

The questionnaire assessed age, marital status, education, occupation, date of diagnosis, received treatments and whether they participated in an oncologic revalidation programme (fitness sessions and psychosocial education during 12 weeks).

Determinants of physical activity

A newly designed questionnaire on psychosocial determinants was derived from previous questionnaires in non-diseased [32,33] and cancer populations [25,28,30]. These questionnaires were widely used and showed good reliability and validity [25,33]. Table 1 includes an overview of included subscales and items per subscale of the general and cancer-related determinants. Associated Cronbach's α 's are also indicated in Table 1. All items were scored on a five-point Likert scale.

Levels of physical activity

To assess PA, the long version of the Flemish Physical Activity Questionnaire (FPAQ) was used. The FPAQ was developed to collect detailed information on different dimensions of PA during a usual week and has been proven to be a reliable and valid questionnaire [34]. Four activity variables were calculated, which involved only activities with MET values ≥ 3 (activity levels during household and gardening, transportation, occupation and leisure time) [35]. In addition, a 'total moderate-vigorous-intensity PA index' (total MVPA) was computed by summing those four variables. All variables were expressed as the average time spent per week (min/week). Possible outliers among the four types of PA were truncated to 960 min/week.

Total days per week of MVPA was measured with a self-reported single item of the Dutch Short Questionnaire to Assess Health Enhancing Physical Activity (SQUASH) [36]: 'On how many days a week are you, in total, moderately physically active for at least 30 minutes?'. Although single-item self-reports may be less accurate, studies provided support for the validity and reliability of single-item self-reports of PA [37].

Statistical analyses

Analyses were carried out using SPSS 15.0. Data analyses included basic descriptive statistics for all respondents. As the working status of participants had a major impact on regression analyses, and differences in both PA behaviour and determinants were quite substantial for non-working and working participants, we expect that interventions should be tailored to working status. Therefore, analyses were stratified for the working and non-working groups. Statistical differences for the continuous variables were analysed using an independent *t*-test. Chi-square tests were used for categorical variables.

To get an independent view of the contribution of general versus cancer-related determinants of MVPA, separate multiple regression analyses were conducted using two blocks. Preliminary analyses were conducted to ensure no multicollinearity. For both analyses, relevant sociodemographic variables were entered in a first block. General determinants (analysis 1) or cancer-related variables (analysis 2) were entered as a second

Explaining physical activity after treatment for breast cancer

Table I. Descriptives for PA determinants in non-working and working breast cancer survivors

Subscales	Description of items	Cronbach's α	Non-working		Working		Δ
			M (SD)	% Agree	M (SD)	% agree	
<i>Attitude</i>							
	Being sufficiently physically active is important; healthy						
Instrumental attitude		(0.78)	4.4 (0.6)	98	4.5 (0.5)	99	
Affective attitude	satisfying; pleasant; enjoyable	(0.83)	3.7 (0.8)	63	3.7 (0.9)	62	
<i>Perceived benefits</i>							
General							
Health benefits	Feeling less depressed/less stressed; losing weight; strengthening muscles/bones	(0.70)	3.7 (0.6)	69	3.6 (0.6)	62	
Social benefits	Meeting new people		3.6 (0.9)	58	3.5 (0.9)	52	
Cancer related							
Health benefits	Feeling less tired; decreased current symptoms; better health; decreased risk of cancer recurrence/secondary diseases	(0.80)	3.5 (0.6)	51	3.5 (0.6)	55	
Social benefits	Perceiving return to normal life (as before the cancer)		3.7 (0.8)	65	3.8 (0.9)	70	
<i>Perceived barriers</i>							
General							
Lack of time			2.8 (1.1)	25	3.2 (1.0)	38	***
Lack of interest	Lack of interest/discipline/pleasure; disappointment in PA	(0.83)	2.6 (1.0)	21	2.5 (0.9)	19	
Lack of company			2.6 (1.1)	5	2.5 (1.1)	18	
Lack of facilities	Lack of equipment/skills/facilities/knowledge	(0.86)	2.2 (1.0)	12	2.0 (0.9)	6	*
Perceived obstacles	Bad weather; personal problems	(0.30)	2.5 (0.8)	15	2.3 (0.8)	15	
Cancer related							
Physical side effects	(anxiety for) Pain and oedema; inflammations and injuries; incontinence	(0.67)	2.0 (0.9)	7	1.8 (0.8)	1	
Body image	Being too shy or embarrassed to do PA		1.8 (1.3)	12	1.6 (0.9)	5	**
Fatigue			2.9 (1.2)	28	2.6 (1.1)	19	**
Lack of energy			3.2 (1.1)	39	3.1 (1.0)	31	
<i>Social influences</i>							
General							
Social norm	My partner/family/friends want me to be physically active.	(0.85)	3.1 (1.0)	45	3.1 (1.1)	50	
Modelling	How frequently does/do your partner, family/friends participate in PA?	(0.73)	2.5 (1.0)	20	2.6 (0.9)	20	
Social support	How frequently are you doing PA together with partner/family/friends?	(0.54)	2.2 (0.9)	7	2.1 (0.8)	5	
Cancer related							
Social norm ^a	My physician wants me to be regularly physically active.		3.7 (1.0)	64	3.5 (1.0)	54	
Social norm ^b	Other survivors want me to be regularly physically active.		3.2 (1.0)	42	3.0 (1.1)	32	
Modelling	How frequently do other survivors participate in PA?		2.5 (1.0)	16	1.2 (1.5)	10	
Social support	How frequently are you doing PA with other survivors?		2.2 (0.9)	11	1.4 (0.8)	4	
<i>Self-efficacy</i>							
General							
Self-efficacy	I feel confident to be sufficiently physically active; I find it difficult to be sufficiently physically active	(0.64)	3.1 (1.0)	40	3.3 (0.9)	45	
Barrier self-efficacy	I feel confident to be sufficiently physically active even when having no company; suffering from muscles aches; being depressed or stressed; spending too much time at work; having much household work; family and friends require more time; an important life event occurs.	(0.86)	2.9 (0.7)	22	2.8 (0.8)	21	
Cancer related							
Barrier self-efficacy	I feel confident to be sufficiently physically active even when suffering from current symptoms/arm problems/fatigue.	(0.78)	2.6 (0.8)	16	2.6 (0.8)	12	

For ease of interpretation, the percentage of participants endorsing a 4 or 5 on the various five-point scales ((strongly) agree, (very) often, (extremely) confident) were calculated.

^aBy physician.

^bBy other survivors.

* $p \leq 0.05$, working versus non-working group (Δ).

** $p \leq 0.01$, working versus non-working group (Δ).

*** $p \leq 0.001$, working versus non-working group (Δ).

block. To generate a total model, a third analysis was conducted, in which the significant general and cancer-related determinants ($p \leq 0.10$) were entered together in the second block, controlled for time post-treatment, chemotherapy and radiotherapy. Before running the regression analyses, all variables with non-significant bivariate correlations with PA ($p > 0.10$) were omitted (represented by lines in the tables).

Results

Study population

Of the 802 breast cancer survivors who had received a questionnaire, 547 (68%) returned their questionnaire. Seventy-three participants did not meet the inclusion criteria (39 were outside the time interval, 25 had an

earlier diagnosis of (breast)cancer, 4 were older than 65 years, 2 had another diagnosis, 2 reported metastases and 1 had another native language). Ten surveys could not be used because of unrealistic outliers in MVPA levels (1) and missing data (9).

Subsequently, data of 464 participants (58%) were included in the analyses. Of those, 32% ($n = 148$) were at work at the time of testing. The general characteristics of the working and non-working groups are shown in Table 2.

Current levels of physical activity and psychosocial determinants

Data on minutes per week of MVPA for all PA domains are given in Table 2. The proportion of respondents that reported less than 210 min per week of MVPA was 54% in the non-working group and 25% in the working group. In both groups, 51% were not moderately physically active for at least 30 min a day.

As Table 1 shows, more women agreed with the general health benefits of PA in comparison with the cancer-related health benefits. Women also reported a higher confidence in overcoming general barriers than the cancer-related ones. Fatigue and lack of energy were the most frequently perceived as barrier, followed by the more general ones.

Table 2. Sociodemographic and medical characteristics and PA levels in non-working and working breast cancer survivors

	Non-working ($n = 316$)		Working ($n = 148$)		Δ
	M (SD)	n (%)	M (SD)	n (%)	
Age	53.1 (8.21)		49.3 (7.45)		***
Weeks post-treatment	13.2 (7.54)		16.2 (6.79)		***
Marital state					
Married/living together		234 (75.0)		109 (73.7)	
Single		78 (25.0)		39 (26.4)	
Education					
Primary school		36 (11.8)		3 (2.03)	***
Secondary school		172 (56.4)		61 (41.2)	
Higher education		78 (25.6)		67 (45.3)	***
University		19 (6.2)		17 (11.5)	
Employment					
Employed		—		148 (100)	
Disabled		161 (51.1)		—	
Retired/no job		154 (48.8)		—	
Treatment					
Surgery		313 (99.6)		147 (99.3)	
Chemotherapy		171 (54.6)		65 (43.9)	***
Radiotherapy		272 (86.4)		126 (85.1)	
Current hormonal therapy		241 (76.5)		113 (76.4)	
Current immunotherapy		39 (12.5)		11 (7.43)	
Onco-revalidation		51 (16.1)		11 (7.43)	*
Levels of moderated PA (min/week)					
Total MVPA	255 (241)		532 (402)		***
Leisure time	91 (148)		92 (132)		
Household	59 (114)		71 (130)		*
Transportation	74 (135)		105 (167)		
Days of ≥ 30 min MVPA	1.4 (1.8)		1.4 (1.9)		

* $p \leq 0.05$.

** $p \leq 0.01$.

*** $p \leq 0.001$.

Association of general and cancer-related determinants with different domains of physical activity in the non-working group of breast cancer survivors

Standardized regression coefficients in the non-working group are reported in Tables 3 and 4 for the general and cancer-related determinants. After controlling for demographics, the models including *general determinants* explained 16% to 17% of the variance in MVPA. The model including *cancer-related determinants* contributed in the explanation of the variance in all domains of PA, with most variance explained for total MVPA (18%), followed by 11% of the variance in total days per week of at least 30 min MVPA and leisure time MVPA.

The model based on both *general and cancer-related determinants* (Table 5) contributed in the explanation for total MVPA (20%), total days per week of at least 30 min MVPA (14%), leisure time MVPA (14%), household (8%) and transportation (4%). The significant determinants of the separate models remained important in the total model. General self-efficacy and enjoyment in PA (affective attitude) had a unique contribution in the explanation of PA depending on PA domain. The perception of returning to normal life, fatigue and lack of energy were significant cancer-related determinants.

Association of the general and cancer-related determinants with different domains of physical activity in the working group of breast cancer survivors

The standardized regression coefficients for the working group are reported in Tables 3 and 4 for the general and cancer-related determinants. After controlling for demographics, the models including *general determinants* explained 13% to 26% of the variance in different MVPA domains. The model including the *cancer-related determinants* contributed in the explanation of the variance in all domains of PA with the exception of household PA, with most of the variance explained by leisure time MVPA (18%), followed by 15% of the variance attributed to total days per week of at least 30 min MVPA.

The model based on both *general and cancer-related determinants* (Table 5) contributed in the explanation of total MVPA (14%), total days per week of at least 30 min MVPA (22%), leisure time MVPA (26%) and transportation MVPA (13%). Social support (from relatives and friends) and barriers (lack of company and lack of time) were also important *general determinants* in addition to the general self-efficacy and the affective attitude. Perceived benefits (returning to normal life) and barriers (physical side effects) were important *cancer-related determinants* depending on the PA domain. The self-efficacy in overcoming cancer-related barriers had a unique contribution in all PA domains.

Explaining physical activity after treatment for breast cancer

Table 3. Hierarchical regression analyses of physical activity in non-working ($n = 316$) and working ($n = 148$) cancer survivors based on general determinants

	Total MVPA (β)		Days (β)		Leisure (β)		Household (β)		Transportation (β)	
	Non-working	Working	Non-working	Working	Non-working	Working	Non-working	Working	Non-working	Working
Block 1 (ΔR^2)	(0.03**)	(0.08***)	(0.03**)	(—)	(0.11***)	(0.05**)	(0.01*)	(0.09**)	(—)	(—)
Age	—	—	-0.12*	—	—	—	—	0.06	—	—
Education level	—	-0.25***	0.10****	—	0.11*	—	-0.13*	-0.15****	—	—
Marital state	—	—	—	—	—	—	—	0.16****	—	—
Onco-revalidation	0.16**	—	—	—	0.25***	0.21**	—	—	—	—
Block 2 (ΔR^2)	(0.17***)	(0.13***)	(0.17***)	(0.25***)	(0.16***)	(0.26***)	(0.07)	(0.02)	(0.02)	(0.14**)
Instrumental attitude	0.02	—	-0.01	0.09	0.04	—	—	—	—	—
Affective attitude	0.09	0.12	0.22**	0.05	0.17*	0.20****	—	—	0.08	0.08
Perceived general health benefit	0.05	—	-0.08	0.12	0.00	0.07	—	—	0.06	—
Perceived general social benefit	—	—	—	—	—	—	—	—	—	—
Lack of time	—	—	—	—	-0.08	—	—	—	—	-0.21**
Lack of interest	0.07	—	-0.14	-0.10	0.03	-0.04	—	—	—	-0.02
Lack of company	0.00	—	-0.11	-0.09	-0.06	-0.13****	—	—	—	—
Lack of facilities	-0.07	—	0.08	—	-0.01	—	-0.02	0.00	—	-0.07
Perceived obstacles	-0.05	—	-0.03	—	0.03	—	-0.04	0.14	—	—
General social norm	—	—	—	—	—	—	—	—	—	—
General modelling	—	—	—	—	0.10	0.00	—	-0.06	—	—
General social support	0.03	0.11	-0.01	0.14****	-0.02	0.13	—	—	—	0.16****
Self-efficacy general	0.28***	0.22**	0.06	0.17****	0.19**	0.10	0.24**	—	—	0.05
General barrier self-efficacy	0.06	0.00	0.07	0.03	0.00	0.06	0.00	—	—	—
Full model statistics										
Multiple R^2	0.20***	0.21***	0.20***	0.25***	0.27***	0.32***	0.08***	0.12**	0.02	0.14*

β : standardized regression coefficient in the full model.

* $p \leq 0.05$.

** $p \leq 0.01$.

*** $p \leq 0.001$.

**** $p \leq 0.10$.

Table 4. Hierarchical regression analyses of physical activity in non-working ($n = 316$) and working ($n = 148$) cancer survivors based on cancer-related determinants

	Total MVPA (β)		Days (β)		Leisure (β)		Household (β)		Transportation (β)	
	Non-working	Working	Non-working	Working	Non-working	Working	Non-working	Working	Non-working	Working
Block 1 (ΔR^2)	(0.03**)	(0.08**)	(0.03*)	(—)	(0.11***)	(0.05**)	(0.01*)	(0.09*)	(—)	(—)
Age	—	—	-0.12*	—	—	—	—	0.06	—	—
Education level	—	-0.33***	0.10****	—	0.13*	—	-0.10****	-0.17*	—	—
Marital state	—	—	—	—	—	—	—	0.19*	—	—
Onco-revalidation	0.12****	—	—	—	0.19**	0.16*	—	—	—	—
Block 2 (ΔR^2)	(0.18***)	(0.13***)	(0.11***)	(0.15***)	(0.11***)	(0.18***)	(0.07***)	(0.03)	(0.04**)	(0.06*)
Perceived cancer health benefit	0.02	—	—	—	0.07	0.20**	—	—	—	—
Perceived cancer social benefit	0.18**	—	0.13*	0.22**	0.09	—	—	—	0.13*	—
Physical side effects	-0.11****	-0.18*	-0.08	—	-0.07	—	-0.07	—	—	—
Body image	—	—	-0.01	—	-0.07	—	0.00	—	—	—
Fatigue	-0.27***	—	0.01	—	-0.07	—	-0.23**	0.14	-0.15**	—
Lack of energy	0.00	-0.06	-0.18*	-0.05	-0.08	—	0.03	-0.09	—	-0.10
Social norm physician	—	—	—	—	—	0.13****	—	—	—	—
Social norm survivors	—	—	-0.10	—	—	—	—	—	—	—
Modelling survivors	0.04	—	—	—	0.07	—	—	—	—	—
Social support survivors	0.02	—	0.07	0.14****	0.04	0.04	—	—	—	—
Cancer barrier self-efficacy	0.07	0.25**	0.07	0.20*	0.09	0.29***	0.06	0.17****	—	0.18*
Full model statistics										
Multiple R^2	0.22***	0.21***	0.14***	0.15***	0.22***	0.23***	0.09***	0.13**	0.04**	0.06*

β : standardized regression coefficient in the full model.

* $p \leq 0.05$.

** $p \leq 0.01$.

*** $p \leq 0.001$.

**** $p \leq 0.10$.

Table 5. Hierarchical regression analyses of physical activity in non-working ($n = 316$) and working ($n = 148$) cancer survivors based on general and cancer-related determinants

	Total MVPA (β)		Days (β)		Leisure (β)		Household (β)		Transportation (β)	
	Non-working	Working	Non-working	Working	Non-working	Working	Non-working	Working	Non-working	Working
Block 1 (ΔR^2)	(0.03**)	(0.13***)	(0.05**)	(—)	(0.11***)	(0.05**)	(0.01*)	(0.06**)	(—)	(—)
Chemotherapy	—	-0.09	-0.17**	—	0.00	—	—	—	—	—
Radiotherapy	—	-0.16*	—	—	—	—	—	—	—	—
Time post-treatment	—	—	—	—	—	—	—	—	—	—
Age	—	—	-0.18**	—	—	—	—	—	—	—
Education level	—	-0.28***	0.10****	—	0.12*	—	-0.11****	—	—	—
Marital state	—	—	—	—	—	—	—	0.25**	—	—
Onco-revalidation	0.16*	—	—	—	0.26***	0.20**	—	—	—	—
Block 2 (ΔR^2)	(0.20***)	(0.14***)	(0.14***)	(0.22***)	(0.14***)	(0.26***)	(0.08***)	(0.02)	(0.04*)	(0.13***)
Affective attitude	—	—	0.25***	—	0.21***	0.27***	—	—	—	—
Lack of time	—	—	—	—	—	—	—	—	—	-0.22**
Lack of company	—	—	—	—	—	-0.16*	—	—	—	—
General social support	—	—	—	0.19*	—	—	—	—	—	0.19*
Self-efficacy general	0.20***	0.21*	—	0.18*	0.22***	—	0.15*	—	—	—
Perceived cancer health benefit	—	—	—	—	—	0.08	—	—	—	—
Perceived cancer social benefit	0.17***	—	0.05	0.17*	—	—	—	—	0.13*	—
Physical side effects	-0.08	-0.14****	—	—	—	—	—	—	—	—
Fatigue	-0.18**	—	—	—	—	—	-0.17*	—	-0.15**	—
Lack of energy	—	—	-0.18**	—	—	—	—	—	—	—
Subjective norm oncologist	—	—	—	—	—	0.27****	—	—	—	—
Social support survivors	—	—	—	0.09	—	—	—	—	—	—
Cancer barrier self-efficacy	—	0.17*	—	0.10	—	0.18*	—	0.15****	—	0.11
Full model statistics										
Multiple R^2	0.23***	0.27***	0.19***	0.22***	0.25***	0.31***	0.10***	0.08**	0.04**	0.13***

β : standardized regression coefficient in the full model.

* $p \leq 0.05$.

** $p \leq 0.01$.

*** $p \leq 0.001$.

**** $p \leq 0.10$.

Discussion

The study aim was twofold: (1) to explore general and cancer-related determinants of PA in a breast cancer population within 6 months post-treatment and (2) to identify the contribution of the cancer-related determinants and general determinants in explaining total and domain-specific PA.

On the basis of the descriptive analyses of general and cancer-related determinants, our findings confirm the positive outlook and the desire to re-integrate in normal life reported by breast cancer survivors [29,38]. However, the findings also indicate that the feasibility and positive role of PA in the recovery of cancer are still not sufficiently known among women who survived breast cancer. Therefore, it is encouraging that more than half of the breast cancer survivors reported that their physician wanted them to be physically active (64% in the non-working group and 54% in the working group). Physicians must be aware of the lower confidence of survivors in the positive effects of PA on cancer-related health and in its feasibility when suffering from cancer-related problems.

Furthermore, our study showed that both general and cancer-related determinants were important in explaining PA. Considering general determinants, self-efficacy, enjoyment, social support (accompanying

by relatives and friends) and barriers (lack of company and lack of time) contributed to the explanation of PA. These findings did not differ from the general population and support the notion that general determinants of PA also remain important in explaining PA after a diagnosis and treatment for breast cancer [27,39]. General self-efficacy and enjoyment proved fundamental and important determinants in explaining PA for all survivors. In contrast, the relationship of social support, lack of time and lack of company with PA was more dynamic and dependent on the working status of the women. Only in working breast cancer survivors did lack of time and company prevent PA, whereas social support from partner and friends contributed to more PA.

Differences between the non-working and working groups also appeared to be important when considering the cancer-related determinants. Only return to normal life as a benefit of PA was found to be an important determinant in both working and non-working survivors. In the non-working group, the amount of PA was also explained by the perceived cancer-related barriers. Fatigue, lack of energy and physical side effects prevented survivors who were (still) not working after their treatment from being more active. In the working group, the self-efficacy of overcoming those cancer-related barriers explained most of the variance in PA.

The impact of working status on the amount of PA is a notable finding because the post-treatment period is known as an unstable period because of the individuals' progress of re-integration [40]. It confirms the need of tailoring interventions to the patient's own situation in contrast with standardized programmes. Interventions targeting non-working breast cancer survivors should focus on symptom management and should teach survivors to change their perception of the current symptoms as a barrier for PA or should support them to choose activities that do not interfere with those barriers. Interventions targeting working breast cancer survivors must support them overcoming cancer-related symptoms and increase their self-efficacy to continue PA even when suffering the cancer-related symptoms.

Our study showed that self-efficacy contributed to the explanation of PA in most domains in both non-working and working groups. Many studies already supported this relationship; however, those studies often defined PA as exercise during leisure time or participation in structured exercise programmes [30,41,42]. Furthermore, our results showed that self-efficacy was also important in explaining daily activities such as household activities, gardening and active transportation. Social influences and health benefits were of minor importance. The belief that PA can reduce fatigue and improve survival (decrease risk of recurrence and secondary diseases) could only predict leisure time PA in a working population. However, it is possible that social influences and health benefits contribute to PA through the concept of self-efficacy [30,43]. Further research is needed to clarify the possible mediating role of self-efficacy for those variables.

The present study is a unique contribution to the literature on PA in breast cancer survivors. First of all, this study examined a broad range of PA domains in breast cancer survivors and showed that the relative contribution of general and cancer-related determinants differed between these PA domains [44]. Leisure time PA was mainly explained by the general determinants (enjoyment and general self-efficacy), and no significant relation with the cancer-related symptoms was found. Because previous studies were focused on leisure time PA, the importance of cancer-related symptoms could be underestimated [26]. Second, the present study focused on a population that just survived breast cancer and transitioned from patient to survivor status. The post-treatment period is seen as a period of uncertainty with a variety of new challenges, higher stress levels and changed social influences [40]. To capture the transition period's acute nature, our study focused on a well-defined time interval (3 weeks to 6 months post-treatment). As a consequence, this study gives new perspectives for PA promotion in survivorship by reporting on the importance of working status and the perception of returning to normal life in explaining PA. As our results showed, working status was related to essential differences in associated determinants. Finally, this study included a large variety of important

and relevant psychosocial determinants of PA, instead of only focusing on constructs of one major theoretical model [45]. This leads to a better understanding of the relative influence of several determinants.

Unfortunately, some limitations are present. The data relied on self-reports of PA, which were subject to possible overreporting [46]. Despite truncating PA levels, total MVPA values remained high. Total scores were calculated by summing all minutes of moderate or vigorous activities of the separated PA domains, which could lead to overestimation of the total score. Accordingly, because for some cancer patients activities of light intensity during household (e.g. ironing, washing dishes, making beds) and work (e.g. standing during teaching, custodial work) (<3 MET) were perceived as rather moderate to vigorous activities [47], higher subjective levels of MVPA could be reported in this population.

We conclude that although mean values differ, both general and cancer-related determinants are important in explaining PA in breast cancer survivors. Interventions should be tailored to the working status and the domain of PA that is targeted. For women in the transition from patient to survivor, PA seems to be an important tool to return to normal life. Therefore, PA including daily activities should be encouraged.

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Explaining physical activity after treatment for breast cancer

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